

# PUBLIC HEALTH REPORTS

*In this issue*



U. S. DEPARTMENT OF HEALTH, EDUCATION, AND WELFARE  
Public Health Service



# OVERSEAS MISSIONS

part of the "Service with Distinction"

# PUBLIC HEALTH REPORTS

Volume 71, Number 7

JULY 1956

Published since 1878

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## frontispiece

A Public Health Service officer tells a group of Liberians about a vaccination they are to receive. A new filmstrip depicts PHS commissioned corps activities (see p. 697).



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*Published concurrently with this issue:*

PUBLIC HEALTH MONOGRAPH No. 38 . . . Surgical experience in selected areas of the United States.

*Selwyn D. Collins, Josephine L. Lehmann, and Katharine S. Trantham.*

48 pages; illustrated. A summary and information on availability appear on page 725.

# **PUBLIC HEALTH REPORTS**

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*Public Health Reports*, published since 1878 under authority of an act of Congress of April 29 of that year, is issued monthly by the Public Health Service pursuant to the following authority of law: United States Code, title 42, sections 241, 245, 247; title 44, section 220. The printing of this publication has been approved by the Director of the Bureau of the Budget, September 17, 1954.

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**U. S. DEPARTMENT OF HEALTH, EDUCATION, AND WELFARE**  
**MARION B. FOLSOM, Secretary**

**PUBLIC HEALTH SERVICE**

**LEONARD A. SCHEELE, Surgeon General**

# Tuberculin Sensitivity of Young Adults in the United States

By CARROLL E. PALMER, M.D., Ph.D., EDWARD F. KROHN, M.D.,  
NICHOLAS E. MANOS, M.A., and LYDIA B. EDWARDS, M.D.

THE rapid and continued decline in tuberculosis mortality during the last decades is changing the approach to tuberculosis control. Interest in the mass X-ray survey for detecting persons with active tuberculosis is being supplemented by interest in the tuberculin test for identifying persons who have been infected by the tubercle bacillus. Large-scale use of the tuberculin test may well receive increasing emphasis for tuberculosis control programs during the coming years.

Interest in tuberculin testing programs is not new. One of the purposes of the Tuberculosis Committee of the American Student Health Association, founded in 1931, was to collect in-

formation on the prevalence of tuberculin sensitivity among college students throughout the Nation (1). And during the 1930's a number of reports were published by Long and associates (2-4), as well as by others (5, 6), on the results of tuberculin testing of college students. A standardized tuberculin product (PPD) became available during the later part of the period, and attention was also directed toward the adoption of a uniform testing technique. The reports, in general, indicated a relatively high frequency of tuberculin reactors in the west, lower frequencies in the central part of the country, and high frequencies in the east. Usually, two doses of PPD were used: a first test with 0.00002 mg. and, for nonreactors to that dose, a second test with 0.005 mg. But results were not reported separately for each dose.

By the early 1940's evidence had accumulated from various studies, particularly from the work of Furcolow and associates (7), that the so-called intermediate dose test with 0.0001 mg. of standardized PPD was sufficient to detect almost all persons with active tuberculous disease or other signs of tuberculous infection. Results of subsequent studies in this country and abroad (8-12) confirmed the earlier findings with the intermediate dose test and, in addition, indicated that most of the sensitivity brought out only by larger doses of tuberculin is not related to tuberculous infection or disease. Such low-grade sensitivity shows pronounced variation with geographic area, being almost

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absent in some localities and highly prevalent in others. It may therefore be assumed that low-grade (nonspecific) sensitivity has inflated the frequency of positive reactors reported from studies in which either 1 mg. of O.T. or 0.005 mg. of PPD has been used as the final dose. The intermediate (0.0001 mg.) dose gradually became more widely accepted, and in 1950 it was recommended by the National Tuberculosis Association for a single-dose testing procedure (13). The intermediate dose was adopted also by the World Health Organization for tuberculin testing in its international tuberculosis and BCG programs (14).

Testing with the intermediate dose of standardized PPD-S, Palmer and associates (8, 9) found an average frequency of about 12 percent reactors among more than 20,000 young white women entering schools of nursing in various parts of the country between the years 1943 and 1949. The frequencies ranged from less than 10 percent in residents of some of the midwestern States to around 17 percent in girls from the east coast and more than 20 percent in Oklahoma, Texas, and Indiana. Canada and Babione (15), using the same dose of tuberculin for testing nearly 80,000 Navy recruits and midshipmen in 1948, reported an average frequency of 9.7 percent positive reactors. Although their results were not given by geographic area of residence, the frequency of reactors was significantly higher in the men at the Naval Training Center at San Diego, Calif., than in those at the Naval Training Center at Great Lakes, Ill.

This paper presents the results and discusses the implications of a tuberculin testing program conducted in 1949-51 among more than 120,000 young white adults—Navy recruits and college students—from almost all parts of the United States.

The study, like most public health research projects, represents the cooperative efforts of many persons and groups. In addition to thousands of young men and women who participated as subjects of study, we had the assistance of the medical corpsmen and officers of the U. S. Naval Training Center, San Diego, and Captains Sidney A. Britten and Charles A. Castle of the Tuberculosis Control Section, Preventive Medicine Division, Bureau

of Medicine and Surgery, Department of the Navy. Also cooperating were the directors of student health and their staffs at Berea College, Fort Hays Kansas State College, Iowa State College, Kansas State College, Miami (Ohio) University, Ohio State University, Oklahoma A. and M. College, Purdue University, South Dakota State College, St. Joseph's College and Military Academy, Syracuse University, the universities of Chicago, Colorado, Indiana, Kansas, Kentucky, Minnesota, Missouri, Pennsylvania, and Wisconsin, and various professional schools in New England.

#### Material and Methods

The major part of the study is based on the results of tuberculin testing of 83,599 white men, 17-21 years of age, as they entered the Naval Training Center at San Diego, Calif., during the years 1949-51. In cooperation with the U. S. Navy, arrangements were made systematically to test each new recruit with tuberculin, histoplasmin (16), and coccidioidin and also to obtain a complete residence history. Serious efforts were made to see that no new recruit was missed. The testing was done by a small group of medical corpsmen who were carefully instructed and periodically supervised by Public Health Service research personnel. While some turnover of corpsmen was unavoidable, one principal corpsman was in charge during most of the study period.

In addition, 38,070 white students (22,684 men and 15,386 women) 17-21 years of age were tested during the years 1949-50 in some 35 colleges and universities in 17 States, largely in the middle west. Most of the students were freshmen. The testing was done by a physician or nurse at each college although at the beginning of the program a member of the research staff of the Public Health Service was present to help standardize the testing procedures.

The entire study population, recruits as well as college students, were tested by intradermal injection of 0.1 ml. containing 0.0001 mg. of PPD-S (5 tuberculin units of the international standard PPD). Reactions were read at 48-72 hours by measuring the transverse diameter of induration in millimeters. In this report, a

reaction with an induration recorded as measuring 5 mm. or more has been designated as positive.

Residence histories were obtained by a questionnaire in which each Navy recruit and college student specified, in chronological order, each locality where he had lived since birth. Those who had spent their whole life in one State, without residing elsewhere for periods longer than 6 months, were later classified as "one-state residents." Of the Navy recruits, 56,481 could be classified as one-state residents. Of the college students, 15,148 of the men and 11,250 of the women could be so classified.

One-state residents who had never spent more than 6 months away from one section of their home State were further classified as "one-section

residents." A section consisted of a number of counties with rough adjustment in size for differences in population density. Sections were small in densely populated areas, larger in areas of low population density. A total of 49,404 recruits were one-section residents.

The questionnaire also requested information on the basis of which the type of residence was classified into four groups. Metropolitan residents were defined as those living in cities of more than 100,000 population (according to the 1940 census) or in the suburbs of these cities. Farm residents were those who lived on farms. All other types of residence were classified under the broad heading of "other." And persons with more than one type of residence were classified as "mixed."

**Table 1. Numbers tested and percentage of positive reactors in each group, by age**

Age in years at last birthday	Navy recruits		College students				All groups	
			Male		Female			
	Number tested	Percent positive	Number tested	Percent positive	Number tested	Percent positive	Number tested	Percent positive
17	15,389	8.9	4,209	5.6	3,532	6.0	23,130	7.9
18	21,588	8.4	8,980	7.2	6,583	6.3	37,151	7.7
19	26,073	8.7	3,937	8.8	2,668	7.4	32,678	8.6
20	14,639	10.4	3,059	12.4	1,712	8.0	19,410	10.5
21	5,910	11.4	2,499	14.1	891	10.3	9,300	12.0
Total	83,599	9.1	22,684	8.6	15,386	6.8	121,669	8.8
Mean age in years	19.2		19.1		18.8		19.1	

**Table 2. Numbers tested and percentage of positive reactors in one-state residents and in residents of more than one State**

Residence	Navy recruits		College students				
			Male		Female		
	Number tested	Percent positive	Number tested	Percent positive	Number tested	Percent positive	
<b>One-state residents:</b>							
In States with 200 or more tested	55,706	8.7	14,445	7.5	9,980	6.6	
In States with less than 200 tested	775	7.2	703	7.4	1,270	6.8	
Residents of more than one State	27,118	10.2	7,536	11.0	4,136	7.7	
Total	83,599	9.1	22,684	8.6	15,386	6.8	

Study of geographic differences in the prevalence of tuberculin sensitivity is based primarily on the data from the Navy recruits. The Naval Training Center at San Diego draws recruits from all over the country except the north Atlantic States and the Great Lakes region. And, as all of the men were tested in San Diego with the same tuberculin product and by the same personnel, variations (and errors) in technique would be expected to be distributed at random without regard to previous place of residence. Moreover, though the recruits cannot be re-

garded as representative of the general population of young men of the same age, one could expect those from one locality to be much the same kind of men as those from other localities.

### Results

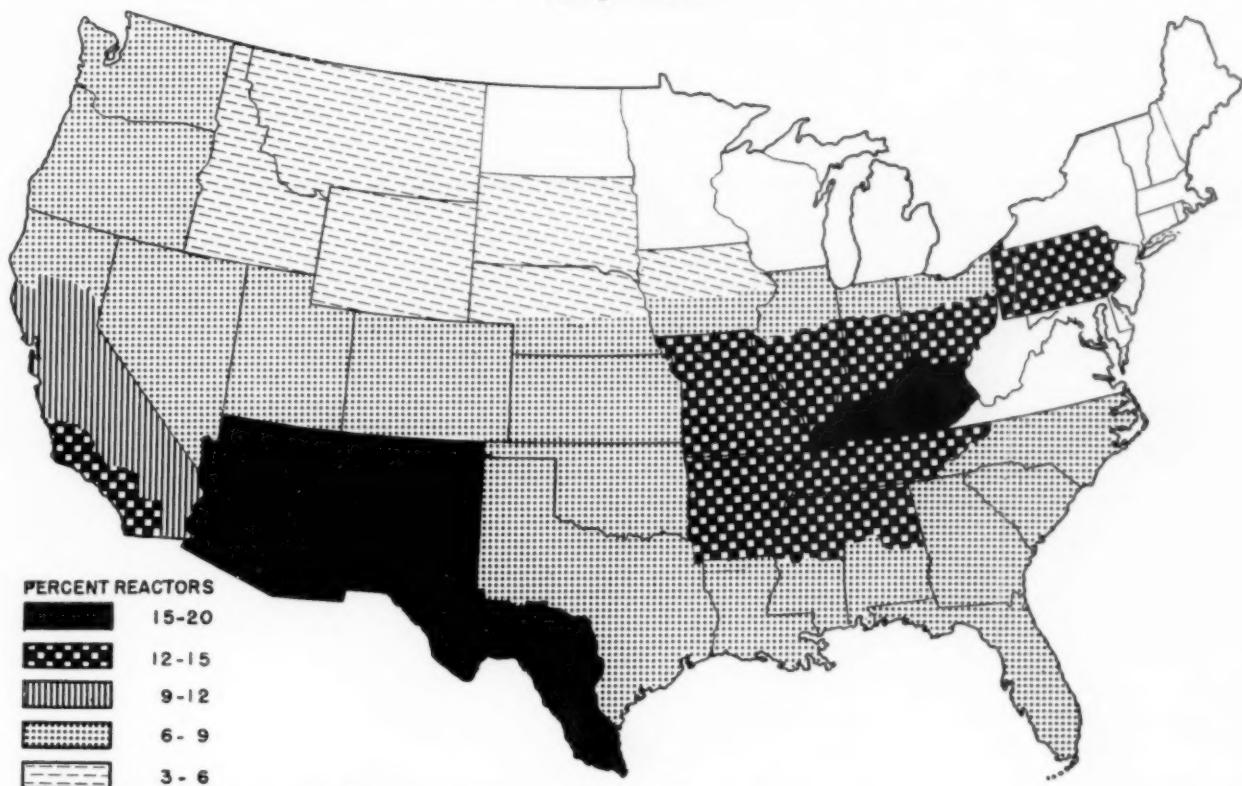
The numbers tested and the percentage with reactions of 5 mm. or more for all of the recruits and college students are given by age in table 1. The overall frequency of positive reactors is 8.8 percent, ranging from 9.1 in the recruits to

**Table 3. Numbers tested and percentage of positive reactors in one-state residents, by State of residence<sup>1</sup>**

State	Navy recruits		College students			
	Number tested	Percent positive	Male		Female	
			Number tested	Percent positive	Number tested	Percent positive
Alabama	1,981	8.0				
Arizona	472	22.7				
Arkansas	1,785	8.9				
California	8,496	11.6				
Colorado	1,444	8.2	308	9.7		
Florida	1,469	5.3				
Georgia	1,961	7.2				
Idaho	708	3.4				
Illinois	879	9.7	1,689	8.5	1,156	9.7
Indiana	1,125	10.0	1,478	7.9	831	6.0
Iowa	2,567	4.9	640	3.8	318	5.7
Kansas	1,900	6.2	2,577	4.5	1,651	3.6
Kentucky	1,010	16.7	534	15.5	374	12.0
Louisiana	1,533	7.4				
Massachusetts					433	10.8
Minnesota					1,255	5.1
Mississippi	1,337	7.3				
Missouri	2,336	11.6	879	9.6	535	8.2
Montana	839	5.6				
Nebraska	1,580	3.9				
New Jersey			246	7.3		
New Mexico	601	18.0				
New York			1,333	8.3	779	7.3
North Carolina	2,645	6.0				
Ohio	1,341	11.1	2,079	7.8	1,172	5.4
Oklahoma	2,170	8.9	1,035	7.9	837	6.1
Oregon	1,182	6.9				
Pennsylvania	531	10.9	362	12.2		
South Carolina	1,308	5.0				
South Dakota	401	4.5	275	5.5		
Tennessee	1,788	11.3				
Texas	6,834	8.7				
Utah	976	4.4				
Washington	2,180	6.8				
Wisconsin	327	5.5	1,010	5.0	639	6.9
Total	55,706	8.7	14,445	7.5	9,980	6.6

<sup>1</sup> Excludes States represented by less than 200 persons.

**Figure 1. Distribution of States or sections of States by prevalence of positive tuberculin reactors in Navy recruits.**



States represented by insufficient data are unshaded.

6.8 in the women students. The frequency increases with age, especially in the college men.

The frequency of reactors in the one-state residents was found to be lower than in those who had lived in more than one State (table 2). The latter group also includes all persons born outside of the United States. Further, in the Navy recruits, the frequency of reactors in the States from which 200 or more were tested was higher than in States represented by smaller numbers, mainly States in the north central section of the country and in New England.

The findings among the one-state residents are given in table 3 for States from which 200 or more persons were tested. Except for Kentucky, New Mexico, and Arizona, the percentage of reactors among the recruits does not exceed 12, and for 9 of the 31 States it is less than 6. The same broad pattern of geographic variation is found for the college students although the

prevalence of tuberculin sensitivity is generally lower than in the recruits.

Based only on one-section residents among the Navy recruits, the area covered by the 31 States has been divided into five different levels of prevalence of tuberculin sensitivity (fig. 1). States and sections of States have been grouped in order to show the broad geographic pattern of variation in prevalence of sensitivity. Sectional subdivisions of States have been maintained only where groups of sections appeared to have distinctly different rates from those of the neighboring sections. (For continuity, Nevada has been included although only 96 recruits were tested from that State.)

The map shows that the frequency of tuberculin reactors is less than 10 percent over most of the country, from the northwestern to the southeastern coasts. Areas of significantly higher frequencies appear in some east central States and in the southwest, but only among residents

of Kentucky, Arizona, New Mexico, and the southern part of Texas do the rates exceed 15 percent.

The frequency of tuberculin reactors varies with type of residence. Table 4 shows it is generally highest in the metropolitan and lowest in

the farm residents. It is, therefore, pertinent to consider to what extent the geographic variations shown in table 3 and figure 1 may be influenced by differences in the relative proportions of different types of residence.

The findings by type of residence for recruits

**Table 4. Numbers tested, percentage distribution, and percentage of positive reactors, by type of residence<sup>1</sup>**

Type of residence	Navy recruits			College students					All groups	
	Tested		Percent positive	Male		Female				
	Number	Percent		Number	Percent	Number	Percent			
Metropolitan-----	10,853	24	10.1	4,836	36	8.5	4,254	42	7.2	9.1
Farm-----	11,858	26	6.0	2,721	20	5.3	1,486	15	4.3	5.7
Other-----	22,467	50	9.3	5,983	44	8.0	4,412	43	6.9	8.7
All types-----	45,178	100	8.6	13,540	100	7.6	10,152	100	6.6	8.1
Adjusted to distribution by type of residence of Navy recruits-----					7.4				6.3	

<sup>1</sup> Excludes persons of mixed residence.

**Table 5. Numbers tested and percentage of positive reactors, by State and by type of residence,<sup>1</sup> for Navy recruits from 20 States**

States arranged by decreasing frequency of positive reactors	Metropolitan		Farm		Other residence		All types		Adjusted <sup>2</sup> percent positive	States arranged by adjusted frequency of positive reactors
	Number tested	Percent positive	Number tested	Percent positive	Number tested	Percent positive	Number tested	Percent positive		
1 Kentucky-----	217	13.8	304	14.8	320	16.6	841	15.2	15.4	1
2 Missouri-----	746	12.5	490	6.1	665	14.7	1,901	11.6	12.0	2
3 California-----	3,666	10.9	712	10.0	2,648	11.8	7,026	11.1	11.1	4
4 Tennessee-----	417	10.8	562	9.6	477	12.6	1,456	10.9	11.4	3
5 Indiana-----	229	9.6	170	8.8	531	11.5	930	10.5	10.3	5
6 Ohio-----	524	10.5	147	8.8	469	10.9	1,140	10.4	10.3	6
7 Illinois-----	224	7.1	162	7.4	355	13.5	741	10.3	10.2	7
8 Texas-----	1,006	11.1	1,100	4.6	2,900	10.3	5,006	9.2	9.2	8
9 Oklahoma-----	287	7.3	566	8.0	850	9.9	1,703	8.8	8.7	9
10 Colorado-----	342	7.6	250	4.8	549	10.7	1,141	8.5	8.4	11
11 Alabama-----	202	7.9	556	5.9	801	9.7	1,559	8.1	8.3	12
12 Louisiana-----	225	14.2	337	6.2	665	6.3	1,227	7.7	8.6	10
13 Oregon-----	219	5.5	245	3.7	426	10.6	890	7.4	7.5	13
14 Georgia-----	201	9.5	493	4.5	800	7.8	1,494	6.9	7.5	14
15 Washington-----	641	8.4	389	6.4	669	5.4	1,699	6.8	6.5	16
16 Kansas-----	160	11.2	485	3.3	852	6.9	1,497	6.2	7.3	15
17 Florida-----	302	7.9	186	3.8	739	4.2	1,227	5.1	5.2	18
18 Iowa-----	205	7.3	701	2.6	1,163	5.9	2,069	4.9	5.5	17
19 Utah-----	261	7.7	205	.5	308	4.2	774	4.4	4.3	20
20 Nebraska-----	214	7.9	454	2.6	623	3.4	1,291	3.9	4.5	19
Total-----	10,288	10.2	8,514	6.0	16,810	9.4	35,612	8.8	8.9	-----

<sup>1</sup> Excludes persons of mixed residence.

<sup>2</sup> Adjusted to distribution by type of residence of the total.

from the 20 States in which metropolitan, farm, and other residents were each represented by reasonably large numbers are given in table 5. Relative frequencies of reactors for the three types of residence vary considerably from one State to another. However, as shown by the last column in the table, adjustment for the differences in distribution by type of residence has only a limited effect on the order of the 20 States as arranged by frequency of tuberculin reactors. It must be assumed, nevertheless, that type of residence is of greater importance for total frequency of reactors in other States where metropolitan areas, as defined, do not exist, or where the distribution by type of residence is for other reasons less uniform.

The frequency of tuberculin reactors in the

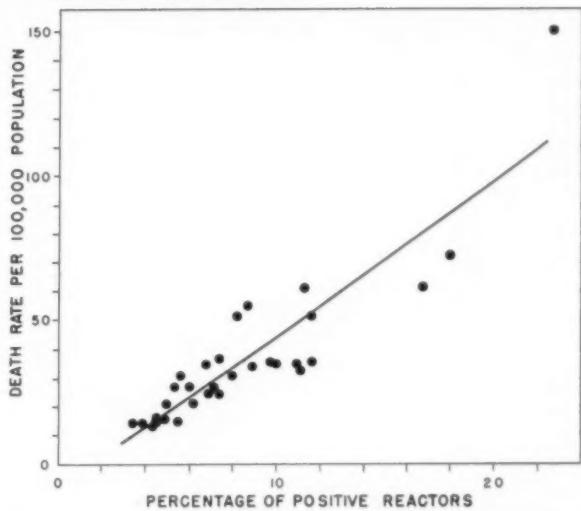
**Table 6. Percentage of positive reactors in Navy recruits (one-state residents<sup>1</sup>) and average annual tuberculosis death rates per 100,000 white population, by State, 1939-41**

State	Percent positive	Tuberculosis death rate <sup>2</sup>
Alabama	8.0	32
Arizona	22.7	150
Arkansas	8.9	34
California	11.6	51
Colorado	8.2	51
Florida	5.3	27
Georgia	7.2	26
Idaho	3.4	14
Illinois	9.7	36
Indiana	10.0	35
Iowa	4.9	16
Kansas	6.2	21
Kentucky	16.7	62
Louisiana	7.4	37
Mississippi	7.3	25
Missouri	11.6	36
Montana	5.6	32
Nebraska	3.9	14
New Mexico	18.0	72
North Carolina	6.0	27
Ohio	11.1	33
Oklahoma	8.9	34
Oregon	6.9	25
Pennsylvania	10.9	35
South Carolina	5.0	21
South Dakota	4.5	15
Tennessee	11.3	61
Texas	8.7	55
Utah	4.4	14
Washington	6.8	35
Wyoming	5.5	15

<sup>1</sup> Excludes States represented by less than 200 persons.

<sup>2</sup> Computed from mortality and population figures given in Vital Statistics of the United States, 1939-41.

**Figure 2. Correlation for 31 States between percentage of positive tuberculin reactors in Navy recruits and average annual death rates from tuberculosis (all forms) for 1939-41 in the white population.**



total study population, as well as in the population used for studying geographic variations, is highest in the recruits, lower in the college men, and lowest in the college women. The differences are statistically significant. They cannot be accounted for by differences in age distribution since that was essentially the same in each group. Nor can they be ascribed to the unequal geographic distribution of the groups.

As shown in table 3, for the 8 States from which more than 200 persons (all one-state residents) were tested within each of the three groups, the prevalence of reactors ranges from relatively high (Kentucky) to low (Iowa). Correction for the inequality in geographic distribution of the recruits and the college students does not reduce the differences in the total prevalence of reactors in those 8 States. The proportion of metropolitan residents is lowest in the recruits, higher in the college men, and highest in the college women (table 4). Consequently, an adjustment of the college student rates to the distribution, by type of residence, of the recruits tends to increase rather than decrease the differences between the groups.

Differences between recruits and college men with respect to tuberculin sensitivity are not found in those who had been residents of more than one State, nor in the one-state residents from States represented by small numbers

**Table 7. Frequency distributions of sizes of reactions among  
Transverse diameter of induration (in millimeters)**

State of residence <sup>1</sup>	Number tested <sup>2</sup>	00	01	02	03	04	05	06	07	08	09	10	11	12
Alabama	1,981	1,795	—	17	7	4	21	12	4	13	6	19	6	7
Arizona	472	355	—	4	3	3	6	5	3	7	7	14	1	14
Arkansas	1,785	1,599	—	14	8	5	8	5	8	14	5	22	9	10
California	8,496	7,438	—	46	15	14	30	21	30	42	34	101	36	73
Colorado	1,444	1,320	—	5	1	—	3	2	4	5	—	12	10	3
Florida	1,469	1,364	—	10	14	3	9	4	4	10	3	17	3	6
Georgia	1,961	1,788	1	14	13	4	17	4	6	10	10	27	5	10
Idaho	708	679	—	4	—	—	1	1	—	1	—	1	3	3
Illinois	879	788	—	3	1	2	4	2	3	4	2	5	5	6
Indiana	1,125	1,005	—	5	1	1	4	1	5	2	2	15	2	13
Iowa	2,567	2,421	—	8	7	5	7	—	6	8	6	12	8	5
Kansas	1,900	1,771	—	8	2	2	8	6	5	4	4	18	4	7
Kentucky	1,010	832	—	2	2	5	4	6	4	19	6	23	5	17
Louisiana	1,533	1,390	—	12	9	8	11	9	14	15	10	7	6	10
Mississippi	1,337	1,213	—	14	9	3	7	10	8	8	5	21	4	8
Missouri	2,336	2,027	—	16	12	9	20	10	11	20	6	41	9	20
Montana	839	788	—	3	1	—	3	1	1	—	—	3	3	1
Nebraska	1,580	1,499	—	9	5	5	2	5	3	3	2	4	1	5
New Mexico	601	487	—	2	1	3	4	1	2	5	3	17	5	6
North Carolina	2,645	2,453	1	15	8	10	11	8	7	13	8	21	5	7
Ohio	1,341	1,186	—	4	2	12	4	6	4	6	6	22	6	12
Oklahoma	2,170	1,939	—	21	7	9	9	9	10	10	8	28	14	14
Oregon	1,182	1,087	—	10	3	1	—	—	1	4	1	7	3	1
Pennsylvania	531	466	—	7	—	—	—	1	3	6	—	12	3	2
South Carolina	1,308	1,222	—	14	4	3	7	2	4	8	3	9	4	5
South Dakota	401	381	—	2	—	—	1	—	2	—	—	2	—	2
Tennessee	1,788	1,573	—	4	1	8	8	7	10	14	7	21	9	17
Texas	6,834	6,130	—	53	28	29	40	26	44	51	31	78	28	45
Utah	976	925	—	3	3	2	1	2	1	—	2	6	3	4
Washington	2,180	2,014	—	11	5	1	3	4	2	3	5	13	4	8
Wyoming	327	305	—	3	1	—	—	—	—	1	—	6	1	1
Total	55,706	50,240	2	336	177	143	258	169	212	304	182	604	205	342

<sup>1</sup> Excludes States represented by less than 200 persons.

<sup>2</sup> Includes only persons classified as one-state residents.

(table 2). Nor is the relative frequency of reactors in college women consistently the lowest in all States represented in the study (table 3).

#### *Tuberculin Sensitivity and Tuberculosis Deaths*

The prevalence of positive reactors in each of the 31 States from which 200 or more recruits were tested was related to the average annual tuberculosis death rates in the white population, by State, for the 3-year period 1939-41, the midpoint in the lives of the 17- to 21-year-old recruits (table 6 and fig. 2). A high positive correlation was found, the coefficient of correlation being 0.88. That finding led to an examination of the relation between the prevalence of positive reactors and other tuberculosis death rates: sex-specific rates for the period 1939-41 and average annual rates for 1929-31 and for 1949-51, as well as the mean annual death rates for all three periods (1929-31, 1939-41, 1949-51). Coefficients of correlation range from

0.84 to 0.93. The difference is not statistically significant.

#### *Variation in Size of Tuberculin Reactions*

Results thus far have been presented in terms of the conventional definition of a positive reaction as one measuring 5 mm. or more. The use of that definition, according to recent studies in many countries (10), may mean that reactions of quite different significance are being classed as positive in different geographic areas. Distributions of the sizes of the reactions were therefore studied, and the basic data are given in table 7.

While the data are inadequate for detailed analysis by single States, pooled results from several States illustrate the difference that may be found between two geographic areas (fig. 3). The figure shows percentage distributions, by size, for reactions measuring 2 mm. or more, for recruits from four northwestern States,

**Navy recruits to the intradermal 0.0001 mg. tuberculin test**

Transverse diameter of induration (in millimeters)

13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28+	State of residence <sup>1</sup>
4	5	22	2	6	3	2	16		5		1	1	1	2		Alabama.
3	2	7	1	4	7	3	5	2	6	2	2	3	2		Arizona.	
7	6	16	8	5	6	1	11	3	3	1	2	6	1		Arkansas.	
29	64	109	43	33	58	19	84	11	34	16	18	34	4	6	54	California.
2	3	13	6	5	7	3	13	3	3	2	1	9		1	8	Colorado.
3	4	6		1	1	1	2		1		3					Florida.
4	5	10		1	6	2	8		3	4	1	2			6	Georgia.
1				1	2	1		3	3	1	1		1	1		Idaho.
4	4	9	5	4	4	2	8	1	1	3		7		1	1	Illinois.
3	7	11	5	4	7		10	1	8	2	1	2	2	1	5	Indiana.
4	9	9	6	9	2	2	8	3	3		3	5	3	3	5	Iowa.
4	2	11	6	5	3		7	3	5	3	1	6		1	4	Kansas.
5	8	20	5	5	6	1	14		4	3	1	7			6	Kentucky.
3	7	6			6	1	6		1						2	Louisiana.
1	3	11	3	1	1		5				1	1				Mississippi.
9	14	24	6	6	15	2	26	2	5	3	3	9			11	Missouri.
2	7	2	2	2	2	1	6	1	3	1			3			Montana.
1	3	8	4	1	3		11		1			1	1			Nebraska.
1	5	10	2	5	8	1	13	1	3	1	1	8	1		5	New Mexico.
2	8	14	1	4	4	3	17	3	3	3		5	2		9	North Carolina.
7	8	16	3	7	8	1	10	1	1	1	2	1	2	2	7	Ohio.
2	11	17	5	3	6	5	22	2	3	2	4	3		1	6	Oklahoma.
5	8	7	4	3	5	4	11	2	3	1	2	2		1	6	Oregon.
2	9	1			1		8		4			4			2	Pennsylvania.
1	1	5	2	2	3	1	3		1			2			2	South Carolina.
1	1	2	1	1	2	1	1		1							South Dakota.
5	8	22	8	8	10	4	16	1	6	1	1	10			9	Tennessee.
17	22	58	15	18	23	9	33	6	14	5	9	10	2		10	Texas.
	4	5	2	2	1	1	4		1	1	1			1	1	Utah.
2	10	18	5	5	10	5	20	2	11	2		4	2	2	9	Washington.
1	1	3			1		2		1							Wyoming.
133	242	480	152	152	220	75	403	48	140	58	55	149	23	22	180	Total.

Idaho, Montana, Oregon, and Washington, and from four southeastern States, Alabama, Georgia, Louisiana, and Mississippi.

The concentration of reactions on "round" numbers (5, 10, 15, and 20 mm.) is obvious and indicates inaccuracy of reading even though serious efforts had been made to obtain precise measurements. (It may be recalled in this connection that each observer tested recruits from all over the country, and thus his inaccuracy would not be expected to bias the measurement of reactions of men from different geographic areas.) A smoothed curve is superimposed on each distribution to bring out the striking contrast between their shapes. While the distribution of reactions for the northwestern States is bimodal with a minimum at about 5 mm., that representing the southeastern group of States is unimodal with a relative concentration of readings in the 2 to 10 mm. range.

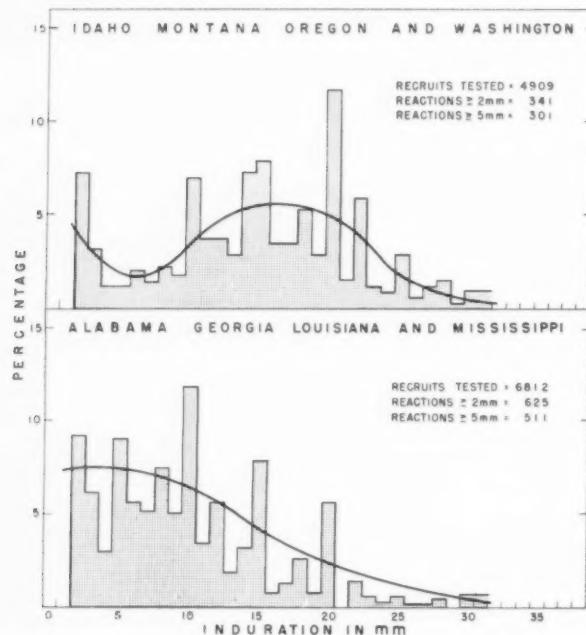
Among reactions commonly classed as positive, those measuring 5 mm. or more, the results

obtained in the two geographic areas may be compared numerically by expressing the frequency of reactions measuring 5-9 mm. as a percentage of all reactions measuring 5 mm. or more. In the four northwestern States, only 10 percent of the positive reactions are less than 10 mm. in diameter; in the four southeastern States, 40 percent are less than 10 mm. Although the two groups of States represented in figure 3 were selected to show the greatest difference in the relative frequencies of small reactions, the data in table 7 indicate that the proportion of small reactions varies considerably from one geographic area to another.

#### Discussion

The findings of the present study confirm a number of recent reports that the frequency of tuberculin reactors among young white adults from over a large part of the United States is, today, very low—less than 10 percent at about

**Figure 3. Percentage distributions of reactions measuring 2 mm. or more to the intradermal 0.0001 mg. tuberculin test in Navy recruits from four northwestern and four southeastern States.**



20 years of age. In a few areas the frequency may be twice as high; but in many, and particularly in the rural parts of the country, it is below 5 percent.

In interpreting these findings it is important to appreciate that the frequency of reactors at 20 years of age represents the result of tuberculous infections that have occurred during the previous two decades. On the assumption that reversion of tuberculin sensitivity is rare, an average prevalence of less than 10 percent corresponds to an average infection rate of about 5 per 1,000 per year. A prevalence of around 5 percent found in many parts of the country implies a still lower infection rate, an average of around 2 per 1,000 per year. There is every reason to believe, however, that the risk of infection has not been constant but has declined during recent years. (Deaths from tuberculosis for the 0- to 19-year-old white population have dropped from 8.2 per 100,000 in 1939-41 to 0.7 in 1954.) At present, the annual rate of tuberculous infection in white children and adolescents over a large part of the country may well be less than 1 per 1,000 per year. Under

such circumstances, most of our children can now be expected to reach adulthood without having acquired a tuberculous infection (19).

Type of residence has been shown by many workers to have considerable influence on the prevalence of tuberculin sensitivity, and our findings are in accord. The frequency of reactors is generally higher in urban than in rural residents. Had metropolitan residents in this study been defined as persons living strictly within city limits, the difference in rates between metropolitan and other residents might have been even greater.

Significant differences are shown in the percentage of reactors among the Navy recruits and the college students, differences that cannot be accounted for by age or by type of residence. They undoubtedly reflect the various factors, including socioeconomic status, that govern whether young men join the Navy or go to college. Among the college students, a higher frequency of reactors among men than women agrees with results of earlier investigations (4, 5). It is not inconceivable that women students on the whole generally come from a higher social stratum than men. The fact that the frequency of reactors is usually about the same among boys and girls up to high school age (17, 18) points again to some form of selection as accounting for the differences between sex-specific rates in college students.

Age, sex, race, and, to some extent, type of residence and probably socioeconomic factors do not, however, account for the broad geographic variations in the frequency of tuberculin reactors among Navy recruits (fig. 1). The variations must be ascribed to other factors, some of which are known to be of influence and some whose influence is entirely unknown. To the former belong ethnic differences and the well-known tendency of tuberculosis patients to move to certain areas, particularly the southwestern part of the country. Factors like those may, to a large extent, account for the high prevalence of reactors in California, Arizona, New Mexico, and part of Texas. Of particular interest is the relatively high percentage of reactors in some of the east central States, where such factors are presumably of less importance.

The high correlation between tuberculosis

death rates and percentage of tuberculin reactors, by States, represents one of the critical results of the present study and must mean that both the frequency of low-dose reactors and the tuberculosis death rates reflect the same general features of tuberculosis in a community.

Recent years have seen a growing interest in large-scale tuberculin testing surveys. In communities where tuberculosis mortality rates are not adequate or not available, results of tuberculin testing may well be the best yardstick of the tuberculosis problem. For pinpointing localities and special situations where infection rates are still high and where energetic control measures could with profit be instituted or strengthened, the test is of unchallenged value. Where, on the other hand, the prevalence rates are low, the use of the tuberculin test as an index of time changes in the tuberculosis problem has distinct limitations. To obtain stable and representative rates would require the testing of very large groups; to estimate conversion rates or to identify an appreciable number of converters would require the retesting of literally tens of thousands of persons.

A number of studies in this country and elsewhere have shown that a high proportion of new cases of tuberculosis—in some areas most of the new cases—come from among the positive tuberculin reactors (20-25). Moreover, the risk of developing clinical disease is apparently much greater for those who have large reactions than for those who have small reactions to a low-dose tuberculin test (23, 25). Perhaps one of the most tangible benefits to be derived from tuberculin testing programs is therefore the identification of the infected persons in the community and, by careful measurement of the reactions, the selection of those most at risk of developing tuberculosis. Careful followup of that selected group can be expected to facilitate early diagnosis and treatment of active disease. And, looking to the future, research studies now in progress offer reason to hope that the antimicrobial agents already found so effective in the treatment of clinical tuberculosis may also prove effective in preventing the development of disease in persons already infected (26).

How efficient are present-day tuberculin testing procedures for excluding from among the persons being called positive those who have

not been infected with the tubercle bacillus? Material from this study, as illustrated in figure 3, shows considerable geographic difference in the sizes of tuberculin reactions generally considered positive. In the north, most of the positive reactions are large and undoubtedly represent specific infection with virulent tubercle bacilli. But in the south, and to a lesser extent in other areas, many of the reactions are small, measuring from 5 to around 10 or 12 mm. in diameter. Distributions similar to those found in the south have been reported from many countries (10) where high proportions of the population have the low-grade kind of sensitivity referred to as nonspecific and where many of the small reactions obtained with a low-dose of tuberculin are believed to be cross reactions representing infection with some organism (probably nonpathogenic) which produces sensitivity to tuberculin.

Many years ago the veterinarians had to face a similar situation with the problem of the "no-lesion reactor"—cattle that reacted to tuberculin yet showed no evidence of tuberculous infection. While the problem is still far from solved, it has long been known that tuberculin sensitivity in cattle may be caused by infection with a variety of micro-organisms, including the avian tubercle bacillus, *Mycobacterium johnei*, and others. The term "nonspecific" is commonly used by veterinarians to denote the tuberculin sensitivity caused by such organisms. Although that term may not be entirely satisfactory, Paterson has recently written that: "Provided the tuberculin is defined—then the reactions it produces may be classified as 'specific' or 'nonspecific.' The reactions produced by mammalian (human or bovine) tuberculin in the subject infected by mammalian tubercle bacilli are specific, by avian tubercle bacilli, nonspecific. The reaction of an avian type sensitized individual to avian tuberculin is also a specific reaction, to a mammalian sensitized, nonspecific" (27).

In the tuberculin testing of cattle, the problem of the no-lesion reactor did not become of practical concern until the prevalence of bovine tuberculosis fell to low levels, until the nonspecific reactors became a significant proportion of all positive tuberculin reactors. We are now entering the same stage in the tuberculin test-

ing of humans. Our problem is no longer simply to separate persons having tuberculin sensitivity from those having no sensitivity; it includes also the discrimination between specific and nonspecific tuberculin sensitivity. While the separation of the two kinds of sensitivity has been improved by using only a small dose of tuberculin, further improvement cannot be expected by further change in dosage (28, 29). The crux of the matter is that with the tuberculin products at present available the smaller specific reactions do not differ in size from larger nonspecific reactions. We need to develop new techniques for distinguishing the two kinds of sensitivity; perhaps a more specific testing product, perhaps comparative testing techniques along the lines developed by the veterinarians to deal with the analogous problem in cattle.

### Summary

Tuberculin sensitivity was studied during 1949-51 in more than 120,000 white men and women, 17-21 years of age, by testing with the intermediate (0.0001 mg.) dose of the international standard tuberculin PPD-S. The study population comprised Navy recruits from all parts of the country, tested as they entered the Naval Training Center at San Diego, Calif., and students, mostly freshmen, attending colleges and universities in 17 States. Residence histories obtained from each person at the time of the testing provided material for studying geographic differences in the prevalence of tuberculin sensitivity.

The average frequency of reactors was 8.8 percent, corresponding to an average annual infection rate of less than 5 per 1,000 during the last two decades. However, prevalence rates among Navy recruits ranged from about 20 percent in lifetime residents of Arizona and New Mexico to less than 4 percent in Idaho and Nebraska. Rates in the college students, while generally lower, reflected similar geographic differences. Residents of metropolitan areas generally had higher rates than farm residents.

A high positive correlation was found between the frequency of reactors among the

Navy recruits and tuberculosis death rates in the white populations of their home States.

The sizes of tuberculin reactions generally classified as positive showed considerable geographic differences in the relative proportions of small and large reactions. In four northwestern States about 10 percent of the reactions measuring 5 mm. or more were from 5 to 9 mm. in diameter in contrast to 40 percent in four southeastern States. The relative preponderance of small reactions is ascribed to a low-grade kind of sensitivity not related to tuberculous infection; whereas most of the larger reactions represent specific sensitivity. Careful measurement of reactions is essential for the efficient identification of persons most at risk of developing clinical tuberculous disease.

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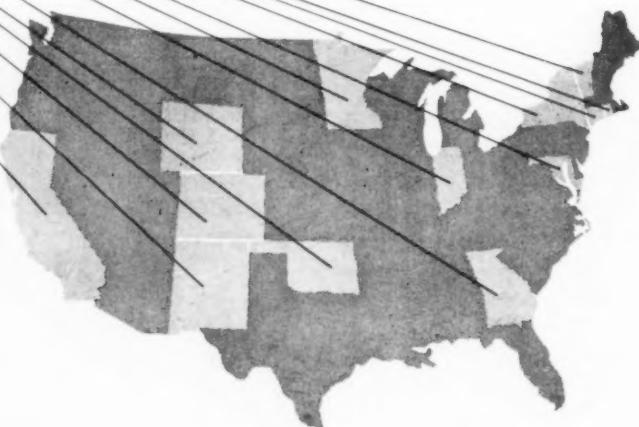
# Proprietary Nursing Homes

## ON PATIENTS AND THEIR CARE

*A Backdrop of Facts*

By JERRY SOLON, M.A.

a  
study  
of the  
proprietary  
nursing homes  
in thirteen states



INFORMATION about the patients and their care is a sensitive means of learning what type of facility nursing homes really are. Taking this approach, 13 States participated with the Commission on Chronic Illness and the Public Health Service in a study of the character-

istics and care of long-term patients in various types of institutions during 1953-54.

A full report of the study will be issued by *Public Health Reports* as a Public Health Monograph. An earlier report has been published as a reprint from *The Modern Hospital* of May 1955 by the Public Health Service under the title, "Patients in Proprietary Nursing Homes."

A description of the proprietary nursing homes of the 13 States in the study is presented here in a brief chart review.

The States in the survey are California, Colorado, Connecticut, Georgia, Indiana, Maryland, Minnesota, New Mexico, New York, Oklahoma, Rhode Island, Vermont, and Wyoming. In composite, they present a fairly representative picture of nursing home patients in the country.

The term "nursing home" was found to have

*Mr. Solon, who has been serving as a research associate of the Commission on Chronic Illness for a study of long-term patients, is health program analyst with the Division of Hospital and Medical Facilities, Public Health Service. The chart review reproduced here is adapted from Mr. Solon's talks at the Commission's 1956 meeting in New York City, February 9, and at the Biennial Round Table Conference of the American Public Welfare Association, December 3, 1955, Washington, D.C.*

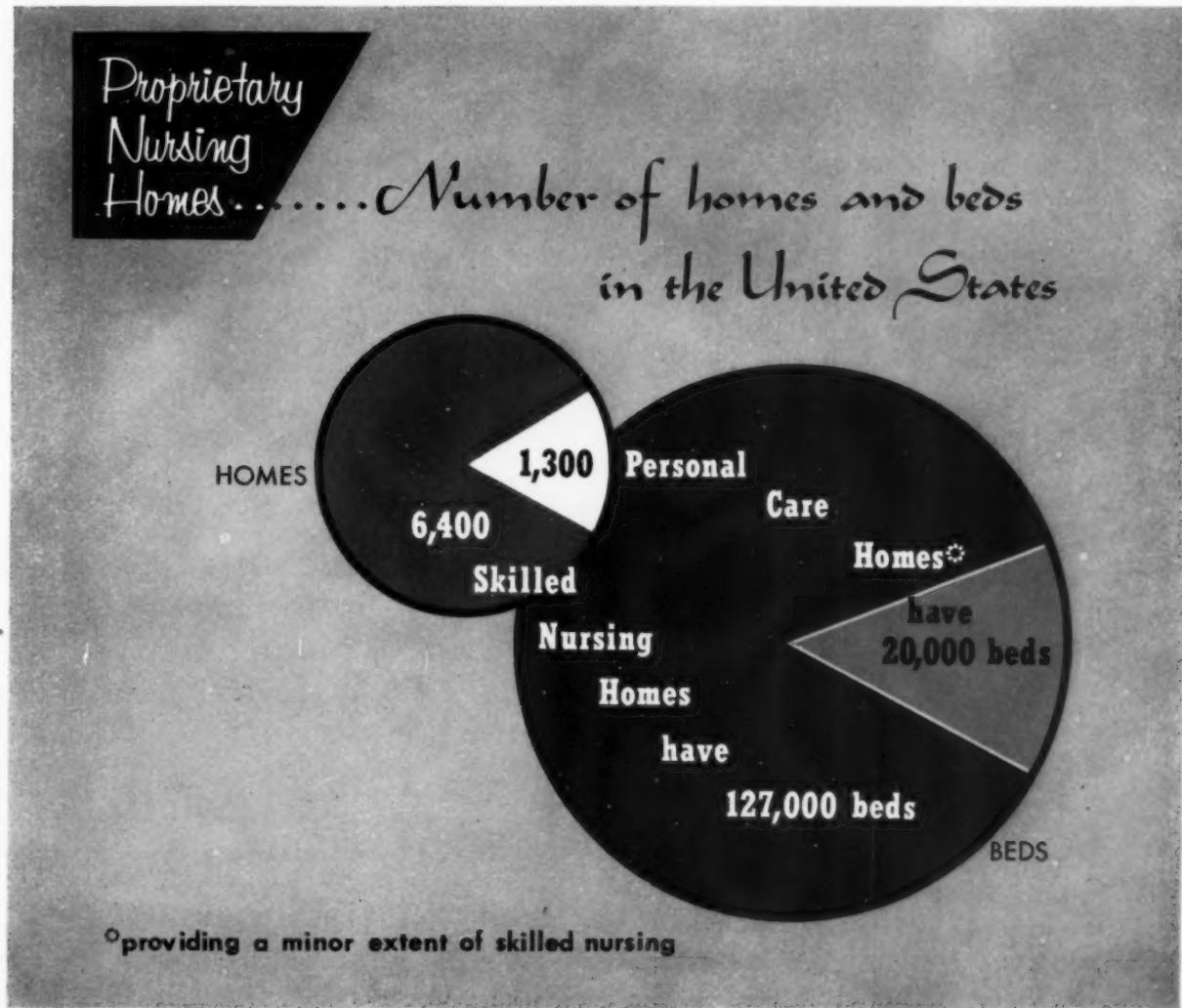
varying connotations among the States. The range of variation was substantially narrowed by application of uniform definitions. Nevertheless, the deeply ingrained local connotations produced some varying interpretation of those definitions.

Generally, however, the types of establishments construed in the study as proprietary nursing homes include those which are defined as "skilled nursing homes" together with those defined as "personal care homes, with skilled nursing." The former provide skilled nursing care as their primary function; the latter furnish some skilled nursing care, but only as an adjunct to a primarily personal care function. These distinctions have been described in two articles in *Public Health Reports*: "Inventory of Nursing Homes and Related Facili-

ties," December 1954, and "Ownership and Size of Nursing Homes," May 1955.

Briefly, skilled nursing care includes some technical nursing procedures beyond those which the untrained person can administer. Personal care includes such services as help in walking and getting in and out of bed, assistance with general bathing, help with dressing or feeding, preparation of special diet, supervision over medications which can be self-administered, and other types of personal assistance.

There are approximately 150,000 beds in proprietary nursing homes of the two types described, as shown in the chart below. Information about the patients and their care in essentially these types of homes in the 13 States surveyed is highlighted in the other charts.



Without question nursing homes today serve a very aged group. Although in other respects sharp differences are observed among the States, in point of the patients' ages the various States present a remarkably uniform picture. The median age of patients in all of these States is about 80 years.

Relatively few patients—barely 10 percent nationally—are under 65 years of age. Only about 1 percent are less than 45 years.

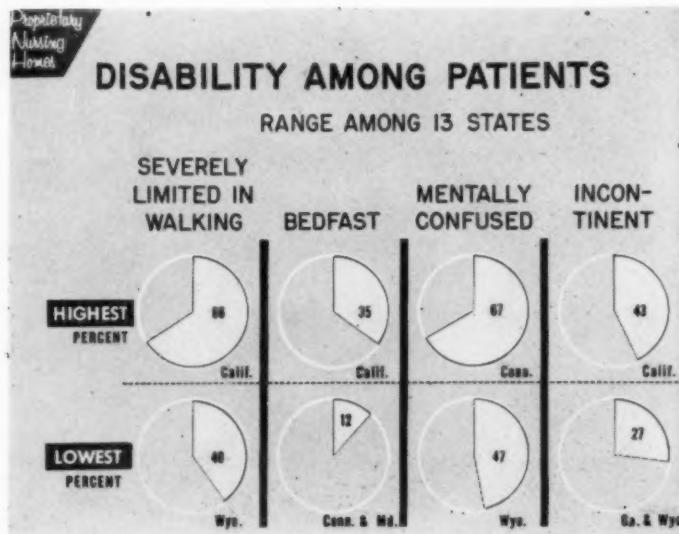
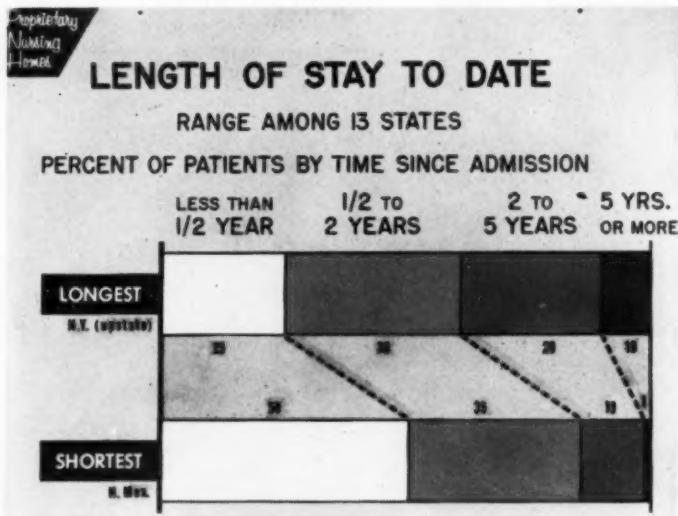
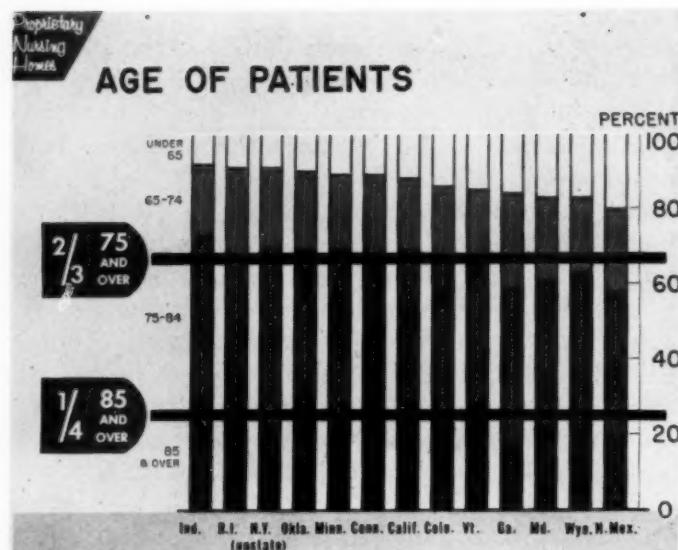
The long periods of residence, along with the patients' advanced ages, emphasize that nursing homes are in a real sense a form of home for the aged.

The median length of residence of the patients in the homes at the time of the survey ranged from 6 months in New Mexico to 1½ years in upstate New York. Some patients stay many years—1 out of 10 of New York's patients had been admitted 5 or more years earlier.

Nursing home patients are heavily disabled. About half of the patients are severely limited in ability to walk—they are unable to get about at all, or require some major assistance such as wheelchairs, walkers, or the help of attendants.

About one-fifth of the patients are completely confined to bed.

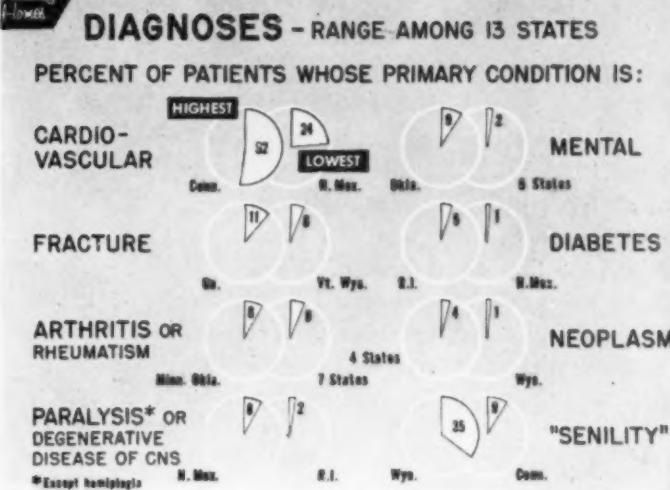
More than one-half are mentally confused, at least part of the time. One-third of the patients were found to be incontinent.



A few of the more common types of diagnoses reported for nursing home patients are shown. These represent only the major condition for which the patient is in the nursing home.

Cardiovascular conditions are the most common; heart diseases and stroke cases with hemiplegia are the major components among these.

In all, it is the chronic diseases which characterize nursing home patients.



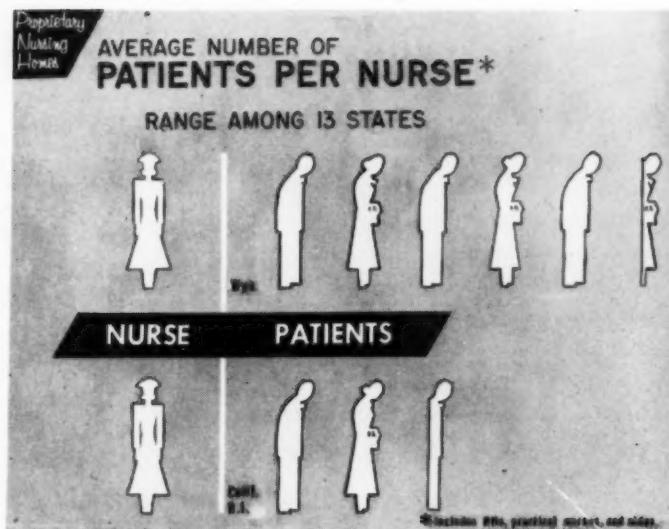
Information about the patients reveals a great deal about the character of the homes. Thus, this brief picture of the patients—aged, heavily disabled, chronically ill, destined for a prolonged stay—outlines a sharp image of the type of facility we have in the nursing home. Even the patients with fractures—normally regarded as an acute condition—usually have a fractured hip, requiring for the older person a prolonged period of care.

A particularly revealing aspect of the nursing home is highlighted by the frequency with which the nonspecific term "senility" is reported as a primary diagnosis for patients. It reflects in very large part the unavailability of more definitive diagnostic information. It points up the fact that the diagnoses reported by the nursing home administrators often lack the backing of medical records or even of medical examination. In what follows we shall see something of the character of the care rendered and of the nature of its medical orientation.

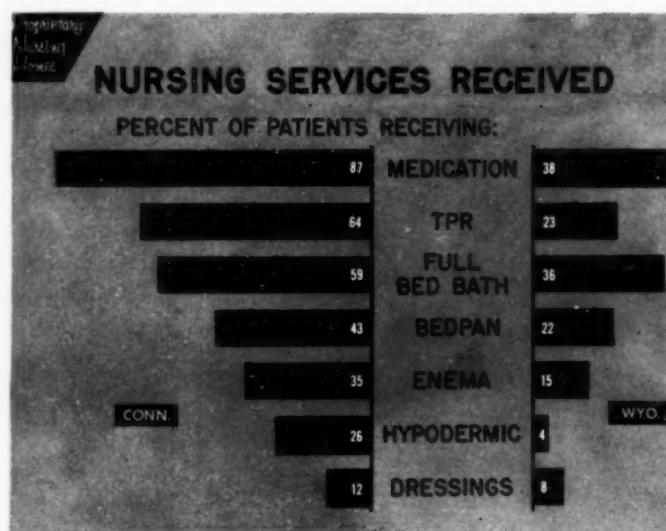
The sharp sweep of the curve marking off the proportion of homes which have a registered professional nurse tells a striking story. Connecticut, at one end of the curve, has a registered nurse in practically every nursing home—in fact, Connecticut prefers to call nursing homes "chronic and convalescent hospitals." At the other end of the curve are Wyoming and Oklahoma, where the home with a registered nurse is practically nonexistent.



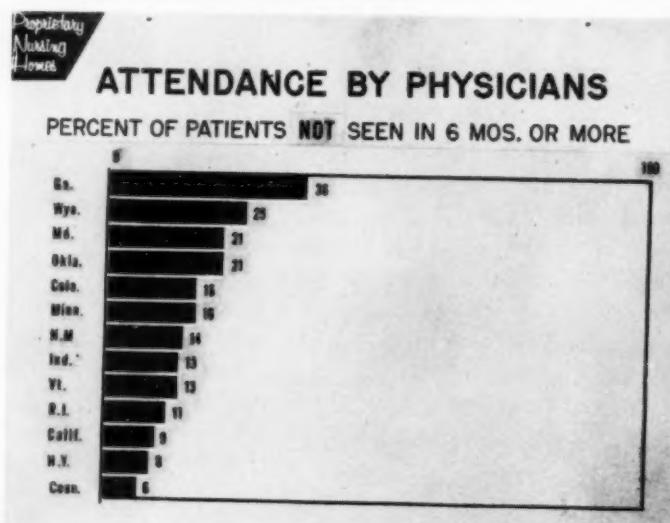
Also important is the number of staff available, in relation to number of patients. The ratio of patients to nurses of all types varies significantly among the States. In California and Rhode Island we find an average of 2.5 patients per nurse (Connecticut is close to this figure with 2.9 patients). Wyoming, at the other extreme, averages 5.2 patients per nursing staff member.



This view of certain nursing services ordinarily given in nursing homes is in key with characteristic differences among States revealed by some of the other charts. The proportion of patients who receive these particular services is shown for Connecticut and Wyoming, two States which frequently appear at opposite poles on the other measures. Much larger proportions of Connecticut's patients receive these services than Wyoming's patients.



The extent to which patients are under close, continuing medical supervision may be a crucial indicator of the general character of nursing homes. Large numbers of the patients are in fact infrequently attended by physicians. The proportion who have not been seen by a physician in as long as 6 months or more mounts in some of the States to one-fifth, one-fourth, and even as much as one-third of the patients.



Proprietary Nursing Homes

Public welfare funds pay for the care of about half of all patients in proprietary nursing homes. In none of the 13 study States do public assistance recipients represent less than one-fourth of the patients. And in several of these States, as many as 7 out of 10 patients are paid for from welfare funds, usually with no other support.

Proprietary Nursing Homes

## PUBLIC ASSISTANCE RECIPIENTS OUT OF EVERY 10 PATIENTS

MINNESOTA  
OKLAHOMA  
WYOMING



CONNECTICUT  
COLORADO  
NEW MEXICO  
NEW YORK (upstate)



INDIANA  
RHODE ISLAND  
GEORGIA



VERMONT

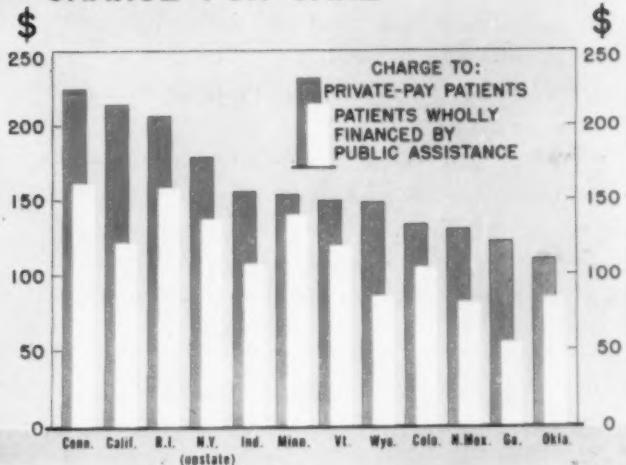


CALIFORNIA  
MARYLAND



PA

## AVERAGE MONTHLY CHARGE FOR CARE



There is consistently a discrepancy between the median payment for care made by public assistance agencies and the average amount paid by patients from their own funds. In some States, the welfare payment is only about half the private-pay average.

Although some of the difference may stem from the luxury accommodations private-pay patients may select, statutory and budgetary ceilings on public assistance payments are known to be a prime factor.

We have seen in this brief review that nursing homes are predominantly oriented toward long-term care, and toward an aged clientele. Their patients are characterized by a considerable degree of disability and by a multiplicity of chronic diseases.

We have observed the range in extent of staffing and intensity of nursing care. We have noted an apparent discrepancy between the character of the patient population on one hand and a relative lack of close and continuing medical attention on the other. Some fundamental implications for our concept of the nursing home role are related to the question of whether

or not nursing homes are medically oriented.

We have recognized that public welfare agencies are very heavily involved in financing nursing home care for public assistance recipients. With so large a proportion of the patients financed from this source, the welfare levels of payment must have a pervasive influence on the quality of care characteristic of nursing homes in general. How large a part public welfare agencies may have in the further development of nursing homes is suggested by their already important role in financing such care. The need for joint effort between the health and welfare agencies is all too apparent.

## Effect of Fluoridated Public Water Supplies on Dental Caries Prevalence

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PHILIP JAY, D.D.S., and JOHN W. KNUTSON, D.D.S., Dr.P.H.

AS EARLY as 1942, it had been adequately demonstrated that the use of fluoride-bearing drinking waters produces a marked reduction in the incidence of dental caries. It was also known by that time that this beneficial effect occurs in populations using water supplies containing fluoride from natural sources in concentrations below the level established as the threshold for mottled enamel or endemic fluorosis (1).

These epidemiological studies suggested the hypothesis that the addition of fluorides to public water supplies would result in a substantial reduction in dental caries. To test this hypothesis and to evaluate the procedure as a method

of caries control, several studies were begun in 1944-45. One of these studies is the Grand Rapids-Muskegon study, conducted by the Public Health Service with the cooperation of the Michigan Department of Health, the University of Michigan, and the city officials of Grand Rapids and Muskegon, Mich. This paper summarizes some of the findings from 10 years of observation in that study.

### General Procedure

As originally planned the Grand Rapids-Muskegon study was designed to continue for a period of 10 to 15 years. This period was selected so that observations would be comparable to those obtained in the basic epidemiological studies on children 12 through 14 years of age with a continuous history of using fluoridated water. The selection of the study areas, the methods and types of examinations, the selection of the annual study groups, and preliminary findings have been reported (2, 3).

Beginning in January 1945, sodium fluoride has been added to the water supply of Grand Rapids, the principal study area. Since that time the fluoride content of the water supply has been maintained at a concentration level of 1 p.p.m. (within the range 0.9 to 1.1 p.p.m.). The water supply at Muskegon, the control area, contained less than 0.2 p.p.m. of fluoride until July 1951. At that time Muskegon began adding fluoride to its water supply to maintain a level similar to that in Grand Rapids. (In this paper, parts per million of fluoride refers to the concentration of the fluoride ion.)

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*The following dental officers of the Public Health Service conduct the annual dental examinations in the Grand Rapids-Muskegon study: Dr. Robert C. Likins, Dr. A. L. Russell, Dr. David B. Scott, Dr. D. E. Singleton, and Dr. Robert M. Stephan. The following dentists, formerly with the Public Health Service, also participated as examiners in the study: Dr. F. S. Loe, Los Angeles, Calif.; Dr. H. B. McCauley, Baltimore, Md.; Dr. S. J. Ruzicka, Cleveland, Ohio; and Dr. Edwin M. Short, Hyattsville, Md.*

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To establish the caries status of the study population before fluoridation of the waters, complete oral examinations with a mouth mirror and explorer were made of virtually all children enrolled in elementary and secondary schools in Grand Rapids and Muskegon in 1944 and 1945. Each year thereafter, similar examinations have been made of selected samples of children in the two areas. (Bite-wing roentgenographic and bacteriological studies on selected samples of children will be reported in subsequent papers.) To provide an "expectancy curve," complete oral examinations were also made, in 1945 and 1946, of school chil-

dren in Aurora, Ill., where it is known the water supply has contained 1.2 p.p.m. fluoride from natural sources for about 50 years.

The annual samples of the school population of Grand Rapids and Muskegon are taken from schools selected as representative of each city as a whole. The samples consist of all available children in certain grades (or in sections of the grades) in these schools. The grades are selected to yield certain age groups. The number of grades has been expanded each year so that for the 10th year of the study a representative sample of children at each age from 5 through 16 years was obtained. The grades

**Table 1. Distribution of continuous resident children examined in Grand Rapids and Muskegon, Mich., according to age, by year of examination**

Age last birthday <sup>1</sup>	Basic examinations, 1944-45	1945	1946	1947	1948	1949	1950	1951	1952	1953	1954
Grand Rapids, Mich.											
4	323	540	300	168	137	75	117	168	116	101	77
5	1,633	1,714	831	886	842	777	720	853	1,087	715	529
6	1,789	1,186	628	663	736	697	748	750	826	1,010	561
7	1,806	149	82	69	55	54	438	423	422	410	751
8	1,647	15	216	135	138	155	501	470	444	390	567
9	1,639	0	525	465	484	519	520	582	720	623	477
10	1,626	0	109	108	111	125	131	141	512	499	515
11	1,556	0	17	18	22	140	130	151	246	291	499
12	1,685	174	85	38	60	130	200	176	211	316	260
13	1,668	953	547	625	600	574	530	497	497	557	224
14	1,690	273	173	196	152	153	130	128	119	111	250
15	1,511	80	53	80	64	64	58	53	80	99	240
16	1,107	4	3	233	245	209	177	198	191	197	198
Total	19,680	5,088	3,569	3,684	3,646	3,672	4,400	4,590	5,471	5,319	5,148
Muskegon, Mich. <sup>2</sup>											
4	20	-	43	18	26	51	41	63	52	43	40
5	402	-	321	348	422	340	359	351	487	370	381
6	462	-	339	312	305	393	310	294	353	397	386
7	408	-	36	42	36	30	274	223	246	209	292
8	376	-	18	13	10	12	190	275	205	212	244
9	357	-	213	215	199	197	227	277	348	258	275
10	359	-	62	57	52	52	51	62	287	311	226
11	293	-	12	10	14	146	141	139	133	175	208
12	328	-	21	19	11	28	43	48	46	163	183
13	377	-	197	207	208	214	173	225	178	228	243
14	369	-	77	50	79	66	63	59	54	51	121
15	292	-	18	44	41	34	35	21	30	35	139
16	248	-	1	199	205	132	146	155	132	161	185
Total	4,291	-	1,358	1,534	1,608	1,695	2,053	2,192	2,551	2,613	2,923

<sup>1</sup> See reference 1 for information regarding the effect of selection of sample by grades on specific age groups.

<sup>2</sup> The basic examinations in Muskegon were not done until late spring of 1945; therefore, no examinations were made in the fall of 1945.

selected for the annual examinations are as follows:

Year	Grade
1945	Kindergarten, 1, 8
1946	Kindergarten, 1, 4, 8
1947	Kindergarten, 1, 4, 8, 11
1948	Kindergarten, 1, 4, 8, 11
1949	Kindergarten, 1, 4, 6, 8, 11
1950	Kindergarten, 1, 2, 3, 4, 6, 8, 11
1951	Kindergarten, 1, 2, 3, 4, 6, 8, 11
1952	Kindergarten, 1, 2, 3, 4, 5, 6, 8, 11
1953	Kindergarten, 1, 2, 3, 4, 5, 6, 7, 8, 11
1954	Kindergarten through 11

Each year of the study, all available children in the selected grades (or section thereof) in each school in the study received dental examinations. Only the records of children aged 4-16 years who had used city water supplies continuously since birth are included in this report. Not included are records of children who lived outside their respective communities

for more than 3 months in any one calendar year. The number of continuous resident children and their distribution by age for each year of the study are shown in table 1.

## Results

The amount of dental caries observed at each annual examination through 1954 in Grand Rapids and in Muskegon is shown in tables 2 and 3. There has been a striking reduction in the amount of dental caries in both the deciduous and permanent teeth. For example, in 1944 the average 6-year-old child had 6.43 def (decayed, extraction indicated, or filled) deciduous teeth; in 1954 the average child had only 2.95 def teeth. This represents a reduction of about 54 percent. Similar results were observed in the permanent teeth of children born since fluoridation started; that is those 6 to

**Table 2. Average number of def<sup>1</sup> deciduous teeth per child<sup>2</sup> in Grand Rapids and Muskegon, Mich., by year of examination**

Age last birthday	Basic examinations, 1944-45	1945	1946	1947	1948	1949	1950	1951	1952	1953	1954
Grand Rapids, Mich.											
4	4.19	5.40	3.43	3.19	3.02	2.75	2.46	2.13	2.17	2.06	2.12
5	5.37	6.15	5.08	3.89	4.03	3.27	2.50	2.27	2.32	2.29	2.50
6	6.43	6.98	5.73	5.38	4.78	4.59	3.73	2.98	2.93	2.92	2.95
7	6.29	7.66	6.11	5.84	5.20	4.83	5.72	4.03	3.48	3.10	3.26
8	5.78	8.00	5.10	5.07	4.88	4.75	4.91	4.12	3.89	3.48	3.31
9	4.59		4.45	4.11	4.43	4.41	4.23	3.86	3.66	3.35	3.00
10	2.84		2.84	3.16	3.06	2.86	2.36	2.43	2.61	2.38	2.35
11	1.35		2.12	2.78	1.77	1.19	1.16	1.35	1.51	1.90	1.32
12	.47	.28	.13	.11	.25	.35	.25	.30	.34	.44	.44
13	.18	.13	.14	.14	.17	.10	.15	.12	.17	.19	.18
Muskegon, Mich. <sup>3</sup>											
4	5.05		3.44	4.67	4.39	4.41	5.32	4.46	4.35	3.44	3.03
5	6.82		5.86	5.05	5.55	5.56	5.65	5.25	5.39	4.42	3.98
6	7.17		6.24	6.18	6.06	5.99	6.02	5.67	5.75	5.71	4.85
7	6.66		6.83	5.95	6.92	6.33	5.83	5.77	5.67	5.46	5.35
8	6.06		4.83	3.85	4.80	6.08	5.06	5.32	5.28	4.95	4.98
9	4.89		4.32	4.34	4.71	4.48	4.09	4.17	4.36	4.29	3.81
10	3.08		3.15	3.67	2.79	2.77	3.49	2.86	2.69	2.96	2.75
11	1.33		1.67	2.90	.64	1.21	1.09	1.46	1.20	1.38	1.42
12	.42		.14	.37	.64	.68	.61	.31	.54	.32	.61
13	.23		.29	.17	.11	.11	.13	.15	.08	.21	.12

<sup>1</sup> Decayed, extraction indicated, or filled deciduous teeth. A decayed and filled tooth is counted only once.

<sup>2</sup> See table 1 for small numbers involved in some instances.

<sup>3</sup> The basic examinations in Muskegon were not done until late spring of 1945; therefore, no examinations were made in the fall of 1945.

**Table 3. Average number of DMF<sup>1</sup> permanent teeth per child<sup>2</sup> in Grand Rapids and Muskegon, Mich., by year of examination**

Age last birthday	Basic examinations, 1944-45	1945	1946	1947	1948	1949	1950	1951	1952	1953	1954
		Grand Rapids, Mich.									
6	0.78	0.56	0.23	0.37	0.26	0.38	0.26	0.26	0.23	0.12	0.19
7	1.89	1.72	1.11	1.09	1.04	.76	1.03	.84	.90	.71	.69
8	2.95	3.27	2.54	2.62	2.30	2.16	1.77	1.58	1.50	1.41	1.27
9	3.90	—	2.98	3.12	2.67	2.48	2.38	2.04	2.02	1.83	1.97
10	4.92	—	3.70	3.56	3.51	3.56	3.17	2.93	2.71	2.41	2.34
11	6.41	—	4.24	3.56	4.32	4.69	4.36	3.67	3.49	3.12	2.98
12	8.07	9.53	7.62	7.03	8.32	7.02	7.10	5.89	5.04	4.76	3.87
13	9.73	10.76	8.92	8.47	8.34	8.11	7.21	6.60	5.87	5.12	5.05
14	10.95	11.90	9.41	9.50	9.41	8.90	8.55	8.21	7.23	5.92	6.78
15	12.48	12.68	11.26	11.94	10.61	11.80	10.12	8.91	9.04	9.75	8.07
16	13.50	13.00	9.33	12.47	13.50	11.83	11.35	11.06	10.14	9.53	9.95
Muskegon, Mich. <sup>3</sup>											
6	0.81	—	0.48	0.66	0.79	0.63	0.75	0.80	0.52	0.35	0.45
7	1.99	—	1.33	1.05	2.19	1.43	2.01	1.88	1.66	1.24	1.14
8	2.81	—	2.83	2.15	3.50	2.58	2.96	2.63	2.49	2.66	2.18
9	3.81	—	3.29	3.54	3.58	3.88	3.89	3.52	3.05	3.22	3.16
10	4.91	—	4.27	3.60	4.87	4.44	4.53	4.32	3.90	3.64	3.72
11	6.32	—	4.25	4.70	4.71	5.93	5.67	5.34	5.04	4.70	4.58
12	8.66	—	8.43	6.79	7.82	7.21	6.88	7.71	7.00	6.53	6.12
13	9.98	—	9.02	9.23	10.52	9.52	9.58	9.36	8.71	8.20	7.98
14	12.00	—	11.09	12.00	12.27	11.08	12.11	11.36	10.06	10.35	10.74
15	12.86	—	11.17	12.89	12.66	10.32	10.94	12.38	11.57	11.69	11.19
16	14.07	—	19.00	12.77	14.31	12.51	13.91	13.16	12.36	11.48	12.55

<sup>1</sup> Decayed, missing, or filled permanent teeth. A decayed and filled tooth is counted only once.

<sup>2</sup> See table 1 for small numbers involved in some instances.

<sup>3</sup> The basic examinations in Muskegon were not done until the late spring of 1945; therefore, no examinations were done in the fall of 1945.

10 years old. It should be noted also that some beneficial effect was obtained by the older children. For example, the 16-year-old children had an average of 13.50 DMF (decayed, missing, or filled) permanent teeth in 1944 and 9.95 in 1954. They were between 6 and 7 years of age when fluoridation started.

A breakdown of the dental caries experience rates for 1954 in the two cities is shown in table 4. For comparison with these results, table 5 offers the findings in 1945 among Aurora, Ill., children, who had used a naturally fluoridated water since birth. The caries experience observed among them is similar to that reported for other areas with fluorides of that concentration (1).

Prior to the decision to add fluoride to the water supply at Grand Rapids, it was concluded that the procedure would not produce an un-

desirable cosmetic effect, that is, mottled enamel. However, it was recognized that an increase in the milder, nonobjectionable forms of dental fluorosis was likely. In order to evaluate this factor fully, it is necessary to wait for observations on all permanent teeth (excluding third molars) which are calcified on fluoridated water. The observations to date give evidence of only a slight increase (0.24 percent in 1944; 0.36 percent in 1954) in the number of children with the milder forms of fluorosis, which are not objectionable from an esthetic or cosmetic standpoint.

#### Discussion

From the results obtained in Grand Rapids after 10 years of water fluoridation, it is quite clear that this procedure is remarkably effec-

tive in reducing the incidence of dental caries. These observations are in accord with the results of similar studies conducted under separate auspices (4-6). The scientific evidence is conclusive, therefore, that water fluoridation is an effective public health procedure for producing a substantial reduction in the incidence of dental caries.

According to this study, the beneficial effects of fluoridated water are not confined to persons drinking the water since birth. The results suggest that some benefit was obtained by per-

sons whose teeth had already formed or erupted when they started drinking fluoridated water. The effects on the teeth of adults in these cities have not as yet been ascertained. However, the fact that a reduction in caries was observed for teeth which had already been calcified when fluoridation was started indicates that some beneficial effect may be gained by older age groups.

The possibility of an increase in dental fluorosis in a community after fluoridation has received considerable discussion. After 10 years

**Table 4. Dental caries in deciduous and permanent teeth of continuous resident children of Grand Rapids and Muskegon, Mich., as observed in the 1954 examination**

Age last birthday	Number of teeth per child						Percent of caries-free children <sup>4</sup>	
	Deciduous teeth		Permanent teeth					
	Filled	Total def <sup>1</sup>	Decayed	Missing <sup>2</sup>	Filled	Total DMF <sup>3</sup>		
Grand Rapids, Mich.								
4	0.68	2.12						
5	1.14	2.50	0.01		0.01	0.02	99.4	
6	1.30	2.95	.11		.09	.19	89.3	
7	1.45	3.26	.36		.35	.69	66.8	
8	1.42	3.31	.52	0.02	.77	1.27	49.4	
9	1.30	3.00	.74	.04	1.26	1.97	33.1	
10	.98	2.35	.73	.07	1.63	2.34	26.6	
11	.63	1.32	.78	.10	2.19	2.98	16.8	
12	.12	.44	1.14	.26	2.55	3.87	13.5	
13	.04	.18	1.56	.44	3.23	5.05	10.7	
14			2.13	.52	4.36	6.78	5.6	
15			2.08	1.02	5.23	8.07	1.2	
16			1.96	1.35	6.90	9.95	2.0	
Muskegon, Mich. <sup>5</sup>								
4	1.18	3.03						
5	.98	3.98	0.03					
6	1.64	4.85	.33	0.00	0.13	.45	79.8	
7	1.96	5.35	.74	0	.41	1.14	49.7	
8	2.03	4.98	1.23	.06	.95	2.18	27.5	
9	1.60	3.81	1.29	.14	1.80	3.16	14.5	
10	1.14	2.75	1.44	.23	2.20	3.72	5.7	
11	.44	1.42	1.79	.32	2.67	4.58	4.3	
12	.14	.61	2.05	.42	3.85	6.12	4.4	
13	.06	.12	2.47	.72	4.97	7.98	1.6	
14			4.31	1.39	5.31	10.74	0	
15			3.55	1.42	6.51	11.19	1.4	
16			2.78	1.42	8.77	12.55	1.1	

<sup>1</sup> Decayed, extractions indicated, or filled deciduous teeth.

<sup>2</sup> Includes teeth listed as "remaining roots" and teeth destroyed beyond any possible repair.

<sup>3</sup> Decayed, missing, or filled permanent teeth; each tooth is counted only once for this total. A tooth that has both a filled and a carious surface is included in both the "Decayed" and the "Filled" columns.

<sup>4</sup> Permanent teeth only.

<sup>5</sup> These children had already received the beneficial effects of 3 years of water fluoridation (see text).

**Table 5. Dental caries in deciduous and permanent teeth of continuous resident children of Aurora, Ill., as observed in the 1945-46 examination period**

Age last birthday	Number children examined	Deciduous teeth		Permanent teeth				Percent of caries-free children <sup>4</sup>
		Filled	Total def <sup>1</sup>	Decayed	Missing <sup>2</sup>	Filled	Total DMF <sup>3</sup>	
		Number of teeth per child						
4	30	0.10	2.07					
5	407	.25	2.79	0.06			0.06	97.3
6	473	.38	3.36	.27	0.00	0.02	.28	84.8
7	516	.44	3.51	.68		.01	.04	66.1
8	469	.54	3.60	.95		.01	.11	55.2
9	368	.49	2.98	1.27		.06	.27	44.8
10	397	.27	2.28	1.55		.09	.51	33.5
11	383	.15	1.18	2.03		.23	.69	27.7
12	401	.05	.43	2.06		.22	.96	26.9
13	401	.01	.13	2.10		.24	1.20	3.09
14	433			2.05		.31	1.58	3.64
15	467			2.37		.50	2.05	4.54
16	371			2.32		.53	2.71	5.19
								14.6

<sup>1</sup> Decayed, extraction indicated, or filled deciduous teeth.

<sup>2</sup> Includes teeth listed as "remaining roots" and teeth destroyed beyond any possible repair.

<sup>3</sup> Decayed, missing, or filled permanent teeth; each tooth is counted only once for this total. A tooth that has both a filled and a carious surface is included under both the "Decayed" and the "Filled" columns. (Note that this table differs from table 2, reference 2.)

<sup>4</sup> Permanent teeth only.

of fluoridation in Grand Rapids, the percentage of children classed as having fluorosis has increased, but, as anticipated, this increase is confined to the milder forms. As pointed out previously (7), the signs of the milder forms of fluorosis caused by ingestion of water containing 1 p.p.m. fluoride as a rule do not appear on the anterior teeth. It is the plan of this study to continue the observations to evaluate this factor fully. Thus far, however, the ingestion of the Grand Rapids water supply has not produced any undesirable cosmetic effect in the form of objectionable dental fluorosis on the anterior teeth.

### Summary

The results of the Grand Rapids-Muskegon study after 10 years of observation indicate that the adjustment of the fluoride content of a communal water to an optimal level (approximately 1 p.p.m. fluoride) will produce the following effects:

1. A striking reduction in the prevalence of dental caries in the deciduous teeth. At the

peak of prevalence, namely 6 years of age, the caries rate for the deciduous teeth was reduced by about 54 percent.

2. A marked reduction in the prevalence of dental caries in the permanent teeth. In children born since fluoridation was put into effect, the caries rate for the permanent teeth was reduced on the average by about 60 percent.

3. Some benefit among persons whose teeth having already formed or erupted when fluoridation is begun.

4. No undesirable cosmetic effect from dental fluorosis.

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## PHS films

### The Public Health Aspects of Migrant Workers

16 mm. Film, black and white, sound, 16 minutes, 1955.

**Audience:** Public health workers, medical societies.

**Available:** Loan—Public Health Service, Communicable Disease Center, 50 7th St. NE, Atlanta 23, Ga. Purchase—United World Films, Inc., 1445 Park Avenue, New York 29, N. Y.

Instruction in the detection and control of communicable diseases in migrant laborers is provided through this film. National problems in controlling diseases associated with this



**Truck showing mode of travel of migrant laborers. Two families of 10 or 12 people traveled 1,000 miles in one of these to get to summer work.**

shifting group are elucidated. These problems have, for many years, been growing.

Since migrant laborers are transients, they do not ordinarily enjoy the rights of citizenship. Any attempt to solve such problems must, therefore, transcend legal obligations to protect the health of citizens.

### Infectious Hazards of Bacteriological Techniques Series: Part VI, The Centrifuge

35 mm. Filmstrip, color, sound, 12 minutes, 86 frames, 1955.

**Audience:** Laboratory or institutional personnel using or teaching the use of the centrifuge in handling infectious organisms.

**Available:** Loan—Public Health Service, Communicable Disease Center, 50 7th St., NE, Atlanta 23, Ga. Purchase—United World Films, Inc., 1445 Park Avenue, New York 29, N. Y.

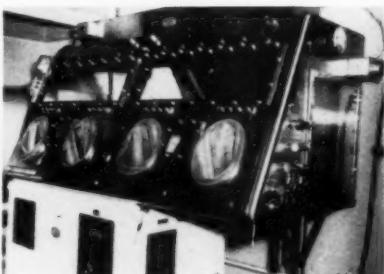
This is one of a series of filmstrips relating to studies of infec-



**Safety cup used to prevent dissemination of aerosols from tubes broken in centrifuge.**



**Air samplers placed to determine aerosol contamination at various distances from centrifuge.**



**Ventilated cabinet developed at Fort Detrick to house refrigerated centrifuge.**

tious aerosols produced by common laboratory operations.

Based on data gathered by the Army's Chemical Corps Biological Laboratories, Fort Detrick, this particular part deals specifically with the centrifuge. It points out some of the hazards of using this apparatus and suggests safe operating procedures.

*Fort Detrick study evaluates relative infectious hazards of microbiological laboratory techniques.*

## Microbiological Safety

By MORTON REITMAN, Ph.D., and A. G. WEDUM, M.D., Ph.D.

LABORATORY workers often have acquired infections during microbiological investigations. A 1951 survey of 1,342 laboratory-acquired infections in the United States revealed 39 deaths, a case fatality rate of about 3 percent (1). In all, recognizable accidents in the laboratory accounted for only 215, or 16 percent, of the infections. The source of most of the illnesses was unknown.

Although literature on industrial and chemical hazards is abundant, little has been published on microbiological hazards until recently (2-9). The Fort Detrick Laboratory Hazards Section, necessarily concerned with the prevention of laboratory infections, has attempted to determine their causes. From observations and from experimentation on infectious laboratory hazards, safety ideas have been developed which may be helpful in decreasing the number of laboratory-acquired illnesses.

### Aerosol Determination

Studies of the potential sources of infection have centered on the hazards associated with common laboratory techniques. The experimental method used has been described previously (5, 7). Essentially, this method involves sampling air with the sieve-type air sampler during standard bacteriological operations such

as pipetting, centrifuging, inoculating and lyophilizing cultures, and autopsy of animals. The operational area is surrounded by samplers, each of which draws air at the rate of 1 cu. ft. per minute through 340 small openings, thereby impinging organisms on the surface of a petri dish agar plate 1-2 mm. below the openings. After a suitable incubation period (36-48 hours at 30° C. for bacteria and 4-16 hours at 30° C. for bacteriophage) colonies or plaques are counted in a Quebec colony counter.

Contamination of the environment is determined also by swabbing surfaces with cotton moistened with nutrient broth. The swabs are streaked on agar plates, which are then incubated as are the air-sampler plates.

Three easily identified organisms were used in these studies: (a) *Serratia indica*, a red pigmented vegetative rod; (b) *Bacillus subtilis* var. *niger*, designated *B. globigii* in Fort Detrick laboratories; and (c) coliphage T<sub>3</sub>. *S. indica* and *B. subtilis* spores were sampled on corn-steep, molasses agar, and coliphage T<sub>3</sub> on tryptose phosphate glucose agar (7).

### Area Contamination Found

Wide variations from average determinations of contamination hazards associated with laboratory procedures are possible (see table). These variations often seem to depend on minor changes in technique peculiar to the individual testing a particular procedure. A reported count of two, for example, means that two colonies grew on the agar sampling plates. It has been reported that most bacteria in the air occur in clumps (10). Also, the efficiency of the sieve

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## Aerosols produced by common bacteriological techniques

Technique	Number of colonies appearing on sampler plates			
	Number of operations	Average	Minimum	Maximum
Agglutination, slide drop technique (one slide)	60	0.3	0	0.66
Animal injections ( <i>Serratia indica</i> ):				
1. 10 shaved guinea pigs injected intraperitoneally with 0.5 ml. culture, no disinfectant	3	15	15	16
2. Same as (1) but injection site disinfected before and after injection with 1 percent tincture of iodine	3	0	0	0
Autopsy, guinea pig:				
1. Immediately after 1 ml. <i>S. indica</i> culture injected intraperitoneally	2	4.5	3	6
2. Immediately after 10 ml. culture injected intracardially	6	3	1	6
3. Grinding tissue 2 minutes in mortar and pestle with 2 ml. sterile broth:				
Guinea pig liver as in (1), 10 ml. inoculum	10	1.8	0	8
Guinea pig heart as in (2)	6	19.5	0	103
Centrifuging:				
1. Pipetting 10 ml. <i>S. indica</i> culture into 50 ml. tube	100	.6	0.1	1.2
2. Pipetting 30 ml. culture into 50 ml. tube	100	1.2	0	5.5
3. Removal of one cotton plug after centrifuging	100	2.3	.8	5.0
4. Removal of one rubber cap after centrifuging	80	.025	0	.25
5. Decanting supernatant into flask	10	17.6	0	115
6. Siphoning supernatant from 10 tubes, each containing 30 ml. centrifuged culture	100	3	0	24
7. Adding 30 ml. saline to one tube of packed centrifuged cells and resuspending by mixing by alternate sucking and blowing with a pipette	100	4.5	.7	12.8
8. One 50 ml. tube breaking in centrifuge but all 30 ml. culture staying in trunnion cup	10	4	0	20
9. As in (8) but culture splashing on side of centrifuge	10	1,183	80	1,800
10. Swabbing outside of centrifuge tubes after filling, centrifuging, taking off supernatant, and resuspending	10	(1)		
One drop of <i>S. indica</i> culture falling 3 inches onto:				
1. Steel surface	200	1.3	.02	4.7
2. Painted wood	200	.3	.01	.6
3. Kem-rock	100	.04	.00	.05
4. Dry hand towel	100	.16	.00	.35
5. Dry paper towel	200	.11	.00	.45
6. Dry wrapping towel	100	.02	.00	.05
7. Towel wet with 5 percent phenol	100	.02	.00	.05
8. Pan of 5 percent phenol	100	.00	.00	.00
Inoculating loop:				
1. Streaking one agar plate with one loopful of <i>S. indica</i> broth culture	10	.6	0	20
2. Streaking one agar plate with one loopful of agar culture	15	4.6 <sup>2</sup>	0	.7
3. Loopful of broth culture striking edge of tube	15	.26	0	
4. Inserting one hot loop into 100 ml. culture in a 250 ml. Erlenmeyer flask	550	.60	0	2.3
5. Inserting one cold inoculating loop into 100 ml. culture in a 250 ml. Erlenmeyer flask	250	8.7	.68	25

sampler in recovering aerosolized particles of heterogeneous size and composition under varying humidities is not easily nor precisely determinable. In the presence of bacterial aerosols of known concentrations, efficiencies have varied from 43 to 73 percent. Therefore, the reported number of colonies is significantly smaller than the actual number of bacteria.

It is evident that certain procedures create

larger amounts of aerosols than others. Grinding tissue with mortar and pestle, decanting the supernatant after centrifugation, resuspending packed cells, inserting a hot loop in a culture, withdrawing a culture sample from a vaccine bottle, opening a lyophile tube, streaking an inoculum on a rough agar surface, and shaking and blending cultures in high-speed mixers appear to be potentially dangerous to the tech-

## Aerosols produced by common bacteriological techniques—Continued

Technique	Number of colonies appearing on sampler plates			
	Number of operations	Average	Minimum	Maximum
Hypodermic syringe and needle [withdrawing 1 ml. phage suspension from rubber-capped vaccine bottle and making ten-fold dilutions in rubber-capped vaccine bottles ( $10^{-1}$ to $10^{-9}$ ), pledge does not always protect fingers against contamination]:				
1. Cotton pledge around needle-----	90	2.3	0	10
2. Ethanol soaked cotton pledge-----	90	0	0	0
Lyophilization:				
1. Breaking one ampule containing 2 ml. of lyophilized <i>S. indica</i> culture in milk plus broth menstruum by dropping on the floor, first 10 minutes-----	10	2,029	1,939	2,040
2. Same as (1), 50–60 minutes after breakage-----	10	741	162	1,447
3. Opening one lyophile tube by filing and breaking tip-----	20	86	4	256
4. Same as (3), but wrapped in 70 percent ethanol soaked cotton pledge-----	50	.08	0	.8
5. Transferring one dry inoculum from one lyophile tube by wire loop-----	50	1.0	0	5
6. Same as (5), but shaking powder into broth tubes-----	20	5.4	0	30
7. Same as (5), but wet inoculum transferred by syringe and needle after reconstituting with one ml. broth-----	10	4.4	0	17
Petri dish plates:				
1. Preparation of pour plate, pipetting one ml. inoculum of <i>S. indica</i> into plate without blowing, and adding melted agar and mixing-----	15	2.6	.2	5
2. Streaking one smooth agar plate with 0.1 ml.; spread with glass rod-----	50	.06	0	.4
3. Streaking one rough agar plate with one loopful of broth culture-----	10	25.1	7	73
4. Same as (3), but using 0.1 ml. and glass rod-----	50	8.7	2	25
Pipettes (also see centrifuging.):				
1. Inoculating 50 ml. broth in 125 ml. Erlenmeyer flask with 1 ml. culture ( <i>S. indica</i> )-----	5	1.2	0	2
2. Mixing 7 ml. broth culture by alternate suction and blowing, without forming bubbles-----	5	.2	0	1
Plug, stopper, or cap removed from culture container of 1–10 dilution of 24-hour broth culture of <i>S. indica</i> :				
1. Escher rubber stopper removed from 5-oz. square dilution bottle immediately after shaking up and down-----	15	5.0	0	20
2. Same as (1), stopper removed after 30 seconds wait-----	15	2.5	0	12
3. Plastic screw cap removed from 8-oz. prescription bottle immediately after shaking-----	15	4.0	0	13
4. Cotton plug removed from 250 ml. Erlenmeyer flask immediately after rotary shaking (dry plug)-----	15	5.0	0	16
5. Same as (4), but wet plug-----	5	10.2	0	35
High speed blender, <i>S. indica</i> culture mixed 2 minutes:				
1. Screw-capped, no rubber gasket (1 minute)-----	10	8.7	0	31
2. Screw-capped, rubber gasket, worn bearing-----	10	61.0	12	126
3. Loose fitting plastic cover-----	15	518	77	>1,246
4. Removing tight cover immediately after mixing-----	15	( <sup>1</sup> )	( <sup>1</sup> )	( <sup>1</sup> )
5. Removing tight cover 1 hour after mixing-----	15	8.2	5	33

<sup>1</sup> Colonies too numerous to count.

<sup>2</sup> Two technicians.

nician if the micro-organisms are infectious. Accidents during centrifugation or handling of dried cultures caused extensive contamination of the laboratory. Practically every manipulation in the microbiological laboratory creates aerosols, and these aerosols are probably the source of many laboratory infections.

### Corrective Measures

#### Bacteriological Cabinets

Protection from infectious particles disseminated into the environment surrounding their source may be afforded by a bacteriological safety cabinet, a modification of the hood or



**Figure 1.** This cabinet may be used without the glove-port panel when small amounts of aerosol are expected.

dry box used for chemical and radiological studies. All potentially infectious operations are thus carried out behind a plane of glass with ventilation sweeping contaminated air away from the technician. When the cabinet is to be used will depend upon the organism, the technique, the skill and immunity of the technician, the seriousness of the possible illness and its possible sequelae, and the relative isolation of the laboratory. A cabinet system is also advisable when there is potential repeated inhalation of large volumes of non-pathogenic micro-organisms. These occasionally cause hypersensitivity (11). Hypersensitivity is also known to develop during the repeated preparation of tuberculin and brucellergen. Nonpathogens have been reported to cause infection in man (12).

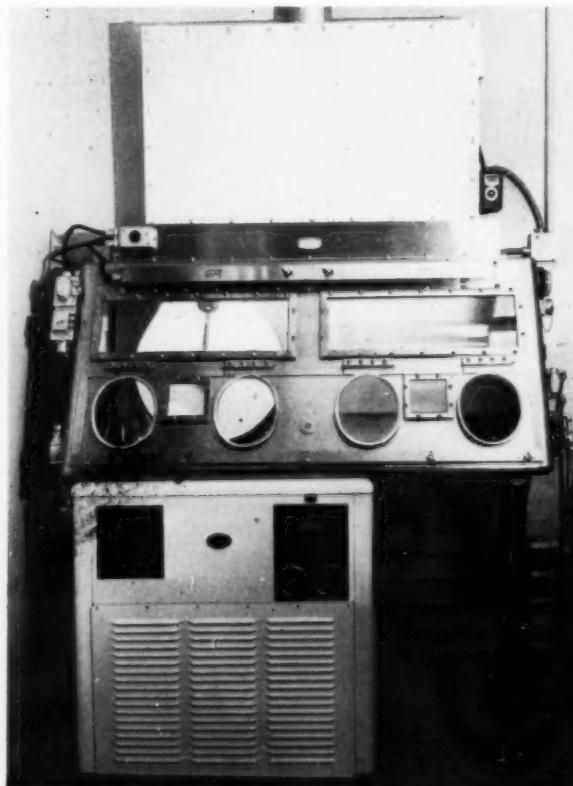
The bacteriological safety cabinet (13, 14) may be simple (fig. 1) or elaborate (fig. 2), depending on the need. When there is a large volume of work, special cabinets are justified for particularly hazardous equipment such as the centrifuge and shaking machines (figs. 3

and 4). Ultraviolet light provides partial disinfection of the cabinet interior; sterilization is best accomplished with steam formaldehyde.

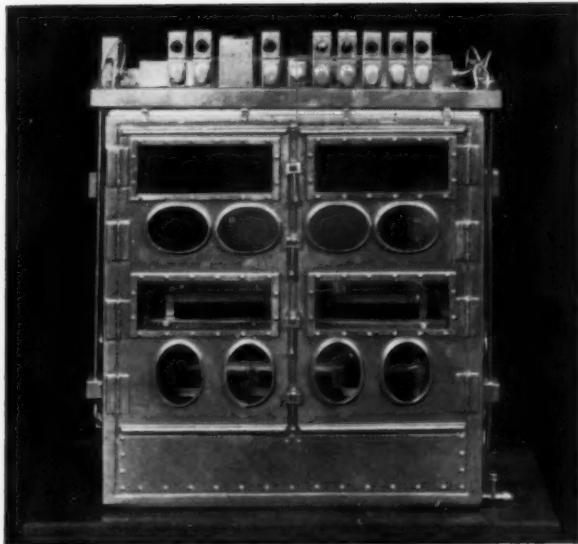
Contaminated cabinet air may be filtered through a bacterial filter or piped directly to some sort of air incinerator. An electric grid



**Figure 2.** Modular gas-tight cabinet system—animal holding, all-purpose, and autopsy cabinets.



**Figure 3.** This centrifuge cabinet may alternatively be used as a bacteriological work cabinet.



**Figure 4. Model of shaking machine-incubator cabinet which may be used to house various types of apparatus.**

incinerator (*A*) has been in use at the National Institutes of Health, Public Health Service, for some time. The efficiency of this incinerator has been reported (15). Individually designed gas or oil fired incinerators are useful for larger volumes of air. Sterilization before renewal or examination of the filter may be accomplished by incorporated electric strip heaters.

#### *The Centrifuge*

For most laboratories, adequate centrifuge safety is possible by use of commercially available screw-capped, safety cups for the swinging head. The angle head in a refrigerated or nonrefrigerated centrifuge has required special attention; a new head has been designed with enlarged recesses to hold the safety cups and will soon be available (*B*). These cups should be filled and opened in a safety cabinet.

#### *Animals and Cages*

Experimentally infected animals can be a source of infectious aerosols (16). Such animals are more safely housed in cages with solid bottoms and sides than in wire cages. A simple method for minimizing dissemination of infectious material is equipping cage racks with ultraviolet fixtures (fig. 5). It has been found that when these are adjusted so as to bathe the area immediately above the cage tops with con-

tinuous ultraviolet radiation at an intensity of about 250 microwatts per sq. cm. no viable vegetative organisms escape from the cages. A more expensive method uses ventilated cages in which all input and exhaust air is filtered (fig. 6).

Depending upon the animal, route of inoculation, cage, bedding, and the micro-organism, the accidental aerosol may not only be a hazard to the technician but may peril the validity of an experiment through cross inoculation of ani-



**Figure 5. Ultraviolet screen across cage tops prevents escape of viable vegetative cells.**



**Figure 6. Filtered air is supplied to individual cages connected to negative pressure manifold.**

mals or augmentation of the test inoculation (16). In some instances, it has become necessary to cage animals individually to insure the validity of an experiment. Before disturbing the debris or cleaning, cages should be disinfected or sterilized, depending upon the infectiousness of the organism.

#### *The Pipette*

The pipette is a significant source of infection, more because of aspiration of liquid than because of inhalation of aerosol. To eliminate the possibility of aspiration and oral contamination, a pipetting device of some kind is desirable (17). There are many pipetting devices which are commercially available, for instance, the aba (C), Adams (D), and Kadavy (E) micropipettors and the aba (C), Caulfield (F), and Fisher (G) pipettors. A new pipetting device which has found favor with the Fort Detrick personnel is the Propipette (H). A simple pipettor can be constructed from a short piece of rubber tubing, or a rubber bulb, such as those used to operate medicine droppers, may be used.

For a pipetting device to be suitable for handling infectious materials outside a safety cabinet, it should not deliver its liquid by forceful ejection, which may produce aerosols. Gravity flow delivery is given by the Caulfield pipettor and the Propipette but not by the other devices mentioned. Contaminated pipettes should be placed in a tray large enough to allow their complete horizontal immersion under a layer of germicidal solution, and the tray should be autoclaved before removing the pipettes.

#### *Other Equipment*

The infectious hazards associated with the use of high-speed mixing bowls have been investigated (5). It was found that bacterial aerosols may be set free by (a) a loose fitting cover, (b) lack of a gasket in a tight fitting cover, and (c) a worn bearing or loosely fastened drive shaft. Aerosols are also liberated during removal of blended materials from the bowls. A leakproof blender bowl has been developed and may be commercially available in the future (5, 16).

Aerosols formed by the process of decavitation during operation of the sonic oscillator

may escape through a loosely fitting cover or when the contents are removed from the sonic cup. Use of a larger size O-ring (No. 24) will generally give adequate closure, while modification of the cover to allow for insertion of a rubber diaphragm so that the contents can be removed by syringe and needle, provides for safe removal of contents. Due to the hazard involved, however, it is best to use a blender or a bacterial sonic disintegrator in a safety cabinet.

#### *Clothing*

It is advisable to wear suitable laboratory clothing in infectious disease laboratories. The long-sleeve, operating gown which ties in the back and is worn over duck trousers is suitable for men, while a smock may be worn by women. A pair of shoes should be reserved for use in the laboratory only. Wearing a surgical cap may be desirable in animal rooms, when showers do not include the hair or when respiratory protective apparatus is used. Preferably, street clothing should not be worn beneath laboratory clothing, since the former may become contaminated if a spill occurs. Infection of laundry workers has proved that it is necessary to autoclave laboratory clothing of personnel working with some infectious agents (19).

Personal cleanliness is an important barrier to infection. Locker rooms should be equipped so that showers may be taken in case of accidental exposure to infectious materials or at the end of the working day. A germicidal soap containing Hexachlorophene is recommended.

#### *Ventilation*

Except in congested areas and with highly infectious agents, sterilization of building exhaust air is of slight importance to the nearby nonbacteriological areas if air from the bacteriological safety cabinets is sterilized. Long experience with this installation has shown (a) that during weeks and months when the exhaust air sterilization system of the general laboratory building was accidentally inoperative (but the cabinet exhaust air was being sterilized), there was no infection of the laboratory personnel or of passers-by and (b) that it is extremely difficult to maintain consistently an air-flow

control such that no potentially contaminated room air escapes into an adjoining "clean area." Proper control of air at the immediate work site may reduce or eliminate the need for exhaust air filtration of the whole building. It should be pointed out that sometimes treatment of air is necessary for public relations or legal reasons. But for the technician, the most important source of infection is within 12 inches of his nose.

### *Education*

Equipping a laboratory with the finest safety devices does not insure against all possible laboratory infections. Equipment is no substitute for safe technique, which is based upon active participation by the worker at the laboratory bench in the process of establishing safe practices. All employees, new and old, should receive safety orientation and training. Supervisors and senior personnel must accept the responsibility for training new personnel and for insisting upon safe practices. A safety manual is an excellent medium for disseminating pertinent information. In our laboratories we have found that the establishment of a laboratory safety council has increased cooperation and facilitated an exchange of ideas. A tangible public award for a good safety record is always an incentive.

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- (A) Electric air sterilizer, Trent Inc., Philadelphia, Pa.
- (B) Centrifuge angle head, International Equipment Co., Boston, Mass.
- (C) Micropipettor and pipettor, Alfred Bicknell Associates, Cambridge, Mass.
- (D) Micropipettor, Clay-Adams Co., New York, N. Y.
- (E) Micropipettor, A. S. Aloe Co., St. Louis, Mo.
- (F) Pipettor, Caulfield Safety Devices, Philadelphia, Pa.
- (G) Pipettor, Fisher-Scientific Co., Pittsburgh, Pa.
- (H) Propipette, Schaar and Co., Chicago, Ill.

# *Changing the Priorities in Public Health*

By GEORGE JAMES, M.D., M.P.H.

THE HEALTH OFFICER is often asked to describe his formula for starting new programs and getting rid of old unproductive ones. This chapter in the art of public health includes more than program development and is considered here under the broader heading, "Changing the Priorities in Public Health." During this era of rapid change in program content, health officers are forced to employ this art to an unusual degree. The present discussion is offered with the hope that some public health practitioners may be aided by statements that reduce their daily problems to simple generalizations which have "deductive fertility."

## **Criteria for Determining a Priority**

The establishment of priority is one of the major responsibilities of the health officer and provides tangible evidence of his capacity for leadership (1, 2). Before giving consideration to changing priorities, it would be well to list some of the criteria for establishing them.

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Those listed below are suggested in part by Ascher (3, 4) and are illustrated by examples from the public health field.

**Urgency.** There is no doubt that the health problems created by a smallpox outbreak or a flood deserve top priority. A breakdown in one of our major barriers against communicable disease, or a mass debacle of any kind, must receive our immediate attention.

**Feasibility.** Often a program could be readily undertaken with existing resources if a slight amount of effort were added. The teaching of self-breast palpation to middle-aged women by public health nurses can be given priority as part of each visit to a new family under the generalized public health nursing program. Similarly, the use of the tuberculosis mass chest X-ray survey for the detection of heart disease is another example of an extra dividend program.

**Scope.** Will the program be of benefit to a significant number of citizens or only a few? Will it be countywide or only of value to one small area? It is obvious, for example, that higher priority will be given to a health education program on the early signs of cancer than one on muscular dystrophy.

**Preparation for something more extensive.** Dr. Ascher calls this the "multiplier effect." Some communities have developed a mobile physiotherapy unit to give simple treatments to home-bound patients with arthritis. This is deemed worthy of priority, since it is probably the first step in a more elaborate program of home care and rehabilitation for all varieties of chronic illness.

**Coordination between existing programs.** Several communities have invested heavily in programs of slum clearance and construction of low cost housing. Health units in those

areas can gear their environmental sanitation activities to make the total program more effective. The health officer is often able to provide the cement which integrates the vital community programs of other agencies. Many examples of this can be found in existing air pollution, hospital planning, and mental health programs.

**Practicality.** This is the old concept of efficiency. When the expected return on a small program investment is very great, it becomes a practical matter to give that program a high priority. In this category one can place fluoridation of the public water supply, since at an annual cost of about 10 cents per capita a two-thirds reduction in dental caries among children can eventually be achieved. Another example is the allocation of official funds for the treatment of cases of ringworm of the scalp because of the far greater community cost of the uncontrolled spread of this disease among school children.

**Special ability or special mandate.** By virtue of its unique skill or legal powers the health department is often the only one or the one best able to perform a particular service. The collection, tabulation, and analysis of morbidity and mortality data, the performance of health services for school children, and the development of inservice medical care programs in municipal government have fallen to the lot of some health officers. It would usually be impossible for a community to develop effective programs in these fields should the health officer fail to give them priority.

**Good will.** The performance of adequate health programs requires a background of community good will and support. Practically every health officer has, on occasion, given high priority to programs of low health importance as a matter of sound public relations. To avoid later confusion, the health officer should openly admit that the chief objective of such a health program is the enhancement of good public relations if that is the fact.

#### Changing the Priorities

The development of any health program requires attention to certain strategic factors in the community. With respect to any one pro-

gram, these factors are favorable or unfavorable to some degree. If entirely favorable, active service may begin immediately; if unfavorable, various subsidiary developmental steps must precede the large-scale program.

The physician who performed a "Smithwick" operation for the hypertensive disease of an influential State legislator was in a favorable position to promote a State hypertension commission. The availability of Federal funds for State industrial hygiene services during World War II resulted in the development of such divisions in the States that had not yet established them. Support for special case-finding programs among hospital admissions by local tuberculosis associations has sold these services to many communities.

The health officer who always waits patiently for the time when strategic factors become favorable can be said to be selecting his priorities on the basis of passive opportunism, that is, priority is given to something dramatic and successful, not necessarily that which is most needed to meet local problems. Such a health officer looks for and pounces upon the health angle of any general project that catches the community's fancy. This evokes that comparison between a statesman and a technician in public health (5), which may be applied to the opportunist. The opportunist in public health pursues fleeting, short-term, popular goals which are dramatic and sure of success; the statesman is not reluctant to lend his prestige to the struggle for those long-range goals which are greatly needed although temporarily neither popular nor feasible.

Lest one be tempted to develop a universal dislike for the public health opportunist, let him be advised quickly to correct that impression. Many of our excellent health programs in child health, medical rehabilitation, and research in chronic disease, owe their origin to a unique and happy combination of local factors. In fact, a health officer should be criticized for not taking advantage of such good fortune. Rather must the test of the practice of passive opportunism come from two other questions:

Having once seized the opportunity, has the health officer proceeded methodically and scientifically to build a firm and successful program, or has he dropped this one for the next fair

prospect which loomed into his jurisdictional field?

Is his total program a conglomerate of activities which arrived opportunely, or has he left his impact upon the field of public health practice through programs developed with a greater sense of his own responsibility for determination of priority?

The health officer of today expects to develop programs even when local strategic factors are not quite satisfactory. This chapter on the art of public health practice is the crux of our current task in the establishment of useful programs against the chronic degenerative diseases and accidents. Several examples will be considered to illustrate how priorities can be changed in the absence of perfection in local strategic factors.

**The active opportunist.** A health officer can act the opportunist even if there are no current opportunities. This might be dubbed "the program plan approach." This health officer sets many irons in the fire. When one of them gets hot, he steps in quickly and forges his program along the lines already planned. Instead of forcing a public reaction, the health officer needs merely wait for public opinion to force the program, which will be any of those he has been holding in readiness.

The danger of such an approach is, of course, that full many an excellent program may be "born to blush unseen." The health literature is replete with excellent program plans which read well but recount only an idea, not a blueprint for action which was effectively taken. After all, how does one judge a program plan which has never been translated into action?

Again, let the reader be assured that there need be no invidiousness attached to this technique of changing priorities. In fact, it is to be highly recommended for those programs which reason tells us are due for the touch of Midas. Health officers would do well to plan thoroughly in the field of adult rehabilitation, home care, radiological health, and mental health. Yet, once having planned, should we not do something more with our script than file it away until D-Day? If not, is there not the distinct danger that some other agency, presumably less well qualified than the trained health department, will seize the initiative be-

cause it happens to be more available to certain newly developing strategic factors?

**The demonstration.** Long an honored approach to the changing of priorities, the demonstration is usually characterized by its heavy accent on quality service. Less well recognized is the fact that the demonstration should be used only when the health officer is sure of his scientific and practical grounds. A demonstration, it should be remembered, can also be taken by our critics as proof that something cannot be done.

In developing the project, care should be taken to bite off no more than can be thoroughly chewed. If you are planning a complete and integrated school health demonstration program, do not try to establish it in your entire district. One census tract, one school, or even one classroom may be all you can handle effectively without compromising quality. The demonstration team must be overstaffed; later on is time enough to prove we can do the job or the major part of the job with less expense and personnel. Public relations skill is required and care must be exercised. The population involved can learn to consider themselves unhappily as guinea pigs, or with good public education, as those fortunate few who are privileged to receive the first chance to participate in an excellent program.

The demonstration approach is useful today for diabetes detection programs, heart disease detection by mass survey, prophylactic treatment of cases of rheumatic fever, and tumor diagnostic clinics. It, perhaps, should not yet be used for obesity control, which still seems to be based upon too much scientific conjecture to be predictable.

**The research approach.** The research project differs from the demonstration in one major respect: Its scientific basis is not yet considered proved. In fact, the central idea of establishing the project is to discover more scientific evidence, although it may also render good service to the study population. Our welfare colleagues have coined the term "service-linked research" as a fitting description of this method of program development (6).

The Albany Cardiovascular Health Center (7, 8) is a good example of this technique of changing priorities. The State civil service's

male population between the ages of 40 and 54 are receiving a complete periodic cardiovascular evaluation under a project established by the New York State Department of Health. Not only is this project stimulating fundamental research among the team who are members of the staff of the Albany Medical College or the State Health Department, but it is also aimed at:

- Evaluating the validity and reliability of techniques for the early diagnosis of coronary heart disease and hypertension.
- Stimulating an interest in heart disease among the staff of this State health department and encouraging them to add heart disease studies and related projects to their own specific programs.
- Giving the best in heart disease detection services to a "susceptible" population.

Similar projects are under way with respect to the study of highway accidents (9), prevention of first attacks of rheumatic fever among school children (10), and home accidents (11) in certain areas. At times this technique is used to iron out the administrative features of a program based upon fairly sound scientific principles. The term, pilot project, is commonly, but not exclusively, associated with this use. Such projects do not necessarily require the firm scientific base of a demonstration project.

**The get-ready approach.** Realizing that he wishes to reach a distant, still unattainable goal, the health officer may undertake a minor program which has a great multiplier effect. This brings him much nearer to coming to grips with the major problem.

In New York State, a program of control of shoe-fitting fluoroscopes was used as the first step in a complete program in radiological health (12). Noting the increasing scope of the problem of ionizing radiation, the department found that the relatively simple task of surveying and correcting the defective units among its 400 shoe-fitting fluoroscopes gave it the opportunity to:

- Acquire much data on the practical risks of ionizing radiation.
- Obtain equipment needed for radiological surveys.
- Stimulate citizen and staff interest in the problem.

- Develop inservice training, both academic and practical, for local health officers and sanitary engineers.

- Develop an extensive program plan, get additional staff, and obtain passage of a complete sanitary code chapter on radiological health.

**The advisory committee.** A problem such as radiological health, which touches many highly skilled professions, should be approached with the most expert advice. The available data must not only be accurate; it must be correctly interpreted. The implications of various control procedures must be appreciated and endorsed by the technical groups which are concerned. An advisory committee of leaders in these fields is essential.

The use of an advisory committee implies certain specific cautions over and beyond the obvious one of obtaining the proper personnel to serve:

- Do as much work as you can before they convene. You cannot afford false starts. These are usually busy people who cannot take the time to teach you fundamentals. Study the field well, send someone away for a special course if it is unfamiliar, and consult in advance with a key member of the committee to be sure you are on the right track.

- Send the material to be considered to each member well in advance, indicating your sources of information, and if possible, areas of special discussion and decision.

- If the group changes the first draft materially be sure that each has an opportunity to review and comment on the final draft.

The technique of the advisory committee has worked unusually well with new programs based upon the self-policing of special groups. Besides its use in radiological health, a State has found it of value in developing a program involving the labeling of household products which may be hazardous if improperly used (13). It has had an excellent trial in several areas for the development of programs of disaster control. Some health departments are now adopting the plan as a practical step toward good public relations in administration by having advisory committees of prominent citizens help define community needs and promote solutions.

**The joint approach.** Often a health officer can accomplish much by coordinating his efforts with those of another agency. His added increment of resources, though slight, may be precisely what is needed to make a worthwhile program a reality. At present, it is possible to work with cancer societies for the development of cancer registers, to tie diabetes surveys in with tuberculosis society mass X-ray programs, and to engage in rheumatic fever prophylaxis programs with heart associations.

In the use of this technique, the health officer is urged to spell out the details of the arrangement in writing. Such problems as the duration of the program, the extent of its evaluation, the next steps, the implications to other programs, are well worth some thought in advance. No health officer should permit his complete program to bog down due to firm, long-range commitments made to so many agencies that he has ended by relinquishing all rights to the determination of priority.

**The advance on many fronts.** Some health officers like to establish a balanced program of new activities; they insist upon having some entry that can be made under each category of public health activity. When something new arises, they do something about it, even if it is on a small scale. This is not a demonstration, not a well-planned approach, not research, not a pilot project, merely something to permit him to dabble lightly in a large variety of services.

If one mentions adult rehabilitation, this health officer reminds us that his public health nurses are following and attempting to return a few hemiplegics to self-sufficiency. If we bring up multiple screening, he has done some hemoglobin and diabetes tests at a county fair. If we mention home accidents, he had his statistician make a 2-month tabulation of patients treated at the emergency room of the local hospital and had a public health nurse follow up on a few of them.

Such public health dilettantism is not necessarily bad. It can be a good first step toward something better and, when this occurs, leads to the concept that there are really no new programs in public health, only changes in emphasis. Best of all, it is often the only way to cajole a reluctant staff. You can sell the care of Mrs. Fred Smith to a nursing division too

busy to accept a "program" in adult rehabilitation. You can get a sanitarian to check the lighting in an apartment hallway when the explanation of your plans for a sanitation home-accident program falls on deaf ears. Using this oblique approach, one can get a community to accept a worthwhile cancer program even before it realizes that something new had been added.

#### **Unloading the Old Program**

Since there are, to put it mildly, limitations to the resources available to local health officers, the addition of new programs means that "something's got to give." Health officers fear, and rightly so, to end programs precipitously. Such action may lead to a general feeling of impermanence and consequent lack of fervid local support toward public health programs. Nevertheless, old programs can be dropped under one of several methods:

**Changing the character or purpose.** The mass chest X-ray for tuberculosis will probably be used increasingly for heart disease and lung cancer detection while its original purpose declines in importance. The female clientele of a venereal disease clinic are easily available for cancer detection, particularly advisable since syphilis (14) and neglected cervicitis (15) are both considered to be precancerous lesions.

**The knife.** The development of modern knowledge about communicable disease control has permitted drastic changes in quarantine regulations and the free distribution of certain antitoxic serums. Occasionally, when available funds have been curtailed, health officers have found it feasible to do this (16).

**Demonstration in reverse.** A real challenge awaits local health officers who would like to explore methods of streamlining some of our traditional health programs. Evaluation studies on the details of prepasteurized milk inspection, water and sewage plant inspections, and some of the routines of school health practice might prove that much current effort could be curtailed. Perhaps better, quick-screening techniques could be employed to give warning of those places or persons requiring detailed individual attention. Such demonstration in reverse, in the sense that it shows how the efficiency of our programs may be improved by

curtailment, should result in the saving of effort which can then be diverted to more valuable services.

**Plus-minus method.** This method can also be called "accentuating the positive." By so doing, attention is drawn away from the unnecessary so that it can be de-emphasized. In milk-production control, one can accent cooling, clean equipment, and cow health, and allow cracks on the floor, area of window space, and certain required partitions to acquire less significance. Greater attention in cancer control can be given in some areas to teaching individual physicians how to perform cancer diagnosis rather than continue to multiply the number of expensive cancer detection clinics. In school health, the development of strong programs of teacher-nurse-parent conferences will draw attention away from unproductive, routine morning clinics.

**Gradual attrition.** Old programs which refuse to die might eventually fade away. County health units which have practiced rigid quarantine for certain common communicable diseases may hesitate to suggest a drastic change in keeping with modern control regulations. There is always the fear that any de-emphasis in control may spread to other disease programs. By avoiding all attempts at stimulating this particular program it can slowly wither until the community is better prepared to take a definite stand at modernizing quarantine regulations.

#### Summary and Conclusion

This discussion seeks to explore a small chapter in the art of public health practice dealing with the ways in which health officers add new services to their entire community health programs. Some of the criteria for the determination of priority are listed and certain principles presented to indicate how these priorities are changed. Examples of the development of new programs and de-emphasis of others are discussed. In general, we require two things of the modern health officer:

- Many individual approaches to public health practice.
- Precise and adequate communication on the plans and results of these practices.

From the mutual stimulation following the

defense of his activities before a jury of his peers will come progress not only in the science of preventive medicine but in the health officer's own very special art of public health practice.

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## Jones Criteria (Modified) for Guidance in the Diagnosis of Rheumatic Fever

RHEUMATIC FEVER is related to previous infection with group A beta hemolytic streptococcus, but the mechanism of the disease is unknown. Its boundaries are indefinite, and its differentiation from other diseases is sometimes impossible. There is no specific laboratory diagnostic test. The diagnosis must therefore be arbitrary and empirical. Criteria herein set forth are aimed at identifying those individuals who have had or are having an attack of rheumatic fever. They make no attempt to measure rheumatic activity at any given time or to diagnose inactive rheumatic heart disease. Thus, following the designation of an illness as rheumatic fever, the existence of continued activity or the presence of inactive rheumatic heart disease may be indicated by criteria different from those outlined below.

Criteria are necessary in order to minimize both overdiagnosis and underdiagnosis. The tendency to label as rheumatic fever a chronic febrile illness for which no obvious cause can be found is to be deplored. The tragedy which may lie in the wake of the false diagnosis of rheumatic fever may be even greater than the possible harm of missed recognition in questionable cases. The institution of effective

prophylactic regimens requiring prolonged administration of sulfadiazine or antibiotic agents places a grave responsibility on the physician in the diagnosis of this illness.

In this statement, the diagnostic features of the disease are divided as originally proposed by Jones into major and minor categories dependent upon their relative occurrence in rheumatic fever and in other disease syndromes from which this disease must be differentiated. Thus chorea is included among the major criteria while fever, a symptom common to many diseases, is placed in a minor category. These major and minor categories have no significance beyond their diagnostic import either as to prognosis, amount of "rheumatic activity," or severity of acute illness. Indeed, a severe manifestation of rheumatic fever such as rheumatic pneumonia is not included because it is difficult to differentiate from congestive cardiac failure and because it almost always occurs in patients whose rheumatic fever is so obvious as to offer no difficulty in diagnosis.

The presence of two major criteria or one major and two minor criteria indicates a high probability of the presence of rheumatic fever with one notable exception (see "other manifestations"). In addition to the major and minor criteria to be used in the recommended formula, other manifestations have been listed which may be used to support the diagnosis. These criteria are not meant to substitute for the wisdom and judgment of the clinician. They are designed only to guide him toward a diagnosis of the disease with the suggestion that he follow carefully all questionable cases and restrict the diagnosis of rheumatic fever to illnesses which meet acceptable criteria.

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*This report of the Committee on Standards and Criteria for Programs of Care of the Council on Rheumatic Fever and Congenital Heart Disease of the American Heart Association has been approved by the executive committee of that council. The original report was published in "Modern Concepts of Cardiovascular Disease," vol. 24, September 1955. In revised form, it is being given wide circulation to support efforts to detect and treat rheumatic fever.*

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## **Major Diagnostic Criteria**

### **Carditis**

*Murmurs.* The presence of a significant apical systolic murmur, apical mid-diastolic murmur, or basal diastolic murmur in an individual without a history of previous rheumatic fever or in whom there is good reason to believe there was no pre-existing rheumatic heart disease; or a change in the character of any of these murmurs under observation in an individual with a history of rheumatic fever or rheumatic heart disease.

*Increasing Cardiac Enlargement.* Obviously increasing cardiac enlargement by X-ray.

*Pericarditis.* Pericarditis manifested by a friction rub, pericardial effusion, or definite electrocardiographic evidence.

*Congestive Failure.* Congestive heart failure (in a child or young adult under 25) in the absence of other causes.

### **Polyarthritis**

Polyarthritis tends to be migratory and is manifested by pain and limitation of active motion, or by tenderness, heat, redness or swelling of two or more joints. Arthralgia alone without objective evidence of joint involvement is not a major manifestation.

### **Chorea**

This must be differentiated from habit spasm, athetosis, and cerebellar ataxia. Movements must be characteristic, involuntary and of moderate severity if chorea is to be used as a major manifestation.

### **Subcutaneous Nodules**

These are shot-like, hard bodies seen or felt over the extensor surface of certain joints, particularly elbows, knees and wrists, in the occipital region, or over the spinous processes of the thoracic and lumbar vertebrae.

### **Erythema Marginatum**

This recurrent, pink, characteristic rash of rheumatic fever, in which the color gradually fades away from its sharp scalloped edge, is found mainly over the trunk, sometimes on the extremities, but not on the face. It is transient, is brought out by heat and migrates from place to place.

## **Background**

In 1944, the late Dr. T. Duckett Jones published criteria for the diagnosis of rheumatic fever which have been generally accepted in the United States and in many parts of the world. Subsequently Dr. Jones guided the revision of his criteria for use in the United Kingdom-United States Cooperative Study on "The Relative Effectiveness of ACTH, Cortisone and Aspirin in the Treatment of Rheumatic Fever," and, just prior to his death, he participated in a conference on the revision of his original suggestions for use by the practicing physician. These modified Jones criteria are based in great measure upon his suggestions.

## **Minor Diagnostic Criteria**

### **Fever**

A significant rise in temperature is a common symptom, but, because it occurs in so many illnesses, it has little differential diagnostic value. In order to be included, the elevation in temperature must clearly exceed the normal diurnal fluctuation in which there is great individual variation.

### **Arthralgia**

Pain clearly located without objective findings is only a minor criterion for diagnosis. The pain must be in the joint, not in the muscles or other periarticular tissues, and must be distinguished from the nocturnal pain in the extremities occurring in normal children. Arthralgia must not be used as a minor criterion when polyarthritis is included as a major criterion.

### **Prolonged P-R Interval in the Electrocardiogram**

Prolongation of the P-R interval may be nonspecific; it is considered a minor criterion and is not diagnostic of carditis. It cannot be used if carditis is already included as a major manifestation.

### **Increased Erythrocyte Sedimentation Rate, Presence of C-Reactive Protein, or Leukocytosis**

Elevation in one or more of these nonspecific tests may be considered as a single minor cri-

terion. Particularly to be deplored is the tendency to use any of these tests as a major criterion or as diagnostic of rheumatic fever. There are many other nonspecific tests, but these three are most commonly used.

#### Evidence of Preceding Beta Hemolytic Streptococcal Infection

This must be documented by (1) a history of scarlet fever or by a typical clinical picture of other streptococcal infection preceding the onset of rheumatic fever by one week to one month, the nature of the infection being confirmed by a history of immediate contact with other individuals having typical streptococcal infection or by positive culture of the nose or throat in which beta hemolytic streptococcus predominates; or (2) an elevated or rising anti-streptolysin-O titer.

#### Previous History of Rheumatic Fever or the Presence of Inactive Rheumatic Heart Disease

The existence of either of these may be used as a minor criterion to aid in deciding the rheumatic nature of the illness in question. For this use, the previous history must be documented by the same objective criteria as are set forth in this statement or by the presence of inactive rheumatic heart disease.

#### Other Manifestations

These include systemic manifestations such as loss of weight, easy fatigability, elevated sleeping pulse rate (tachycardia out of proportion to fever), malaise, sweating, pallor or anemia, and local manifestations such as epistaxis, erythema nodosum, precordial pain, abdominal pain, headache, and vomiting. These, as well as a family history of rheumatic fever, provide additional evidence of the presence of rheumatic fever but are not to be included as diagnostic criteria.

There are combinations of these diagnostic criteria which occur in the presence of other illnesses which must be ruled out before a definitive diagnosis is made. One combination in particular—polyarthritis, fever, and elevated sedimentation rate—is the weakest of all combinations of major and minor criteria. Diseases to be ruled out include rheumatoid arthritis,

gonococcal arthritis, lupus erythematosus disseminatus, subacute bacterial endocarditis, non-specific pericarditis with effusion, leukemia, sickle cell anemia, serum sickness (including manifestations of penicillin sensitivity), tuberculosis, poliomyelitis, undulant fever, and septicemias, particularly meningococcemia.

### Murmurs Indicating Carditis

#### Significant Apical Systolic Murmur

A significant apical systolic murmur is long, filling most of systole; is heard best at the apex; is as well transmitted toward the axilla as over the precordium; and does not change with position or respiration. It must be differentiated from an innocent (functional) murmur which is frequently found in normal people. This innocent murmur is systolic, occasionally harsh, is heard best along the left sternal border and usually changes with position and respiration. Borderline systolic murmurs, intermediate in location and nature, occur and should be carefully watched. Questionable murmurs which are intermittently present or which, after a period of observation, cannot be clearly classified as significant are rarely of any import.

#### Apical Mid-Diastolic Murmur

A significant organic apical systolic murmur is frequently accompanied by a low-pitched, short mid-diastolic murmur which is sharply localized to the chest wall over the apex of the heart and often heard best with a patient in the left lateral position with the breath held in expiration. This murmur, rarely present in the absence of an apical systolic murmur, confirms the significant nature of the latter. It must be differentiated from the long, low-pitched, crescendo apical presystolic murmur followed by an accentuated mitral first sound which is indicative of mitral stenosis but not of acute carditis.

#### Basal Diastolic Murmur

The development of a basal diastolic murmur of aortic insufficiency is also indicative of carditis. It is an early, short, diminuendo murmur usually heard only or heard best along the left sternal border in deep expiration. It has great diagnostic value, even though it may be difficult to hear and present only intermittently.

**NATIONAL HEALTH FORUM**

# chronic illness

THE National Health Forum is conducted each year by the National Health Council to consider a currently pressing health problem. This year the problem was the mounting "daily disaster" of chronic illness.

Because of the wide concern over the magnitude of chronic illness, 800 health leaders attended the 2-day session of the forum in New York City, March 21 and 22, 1956. They came from the 50 national organizations which are the active, advisory, associate, and sustaining members of the National Health Council, from 35 additional national organizations, and from many State and local groups.

Forum participants heard Leonard W. Mayo, chairman of the Commission on Chronic Illness and director of the Association for the Aid of Crippled Children, in the keynote address, say that chronic diseases account for 88 percent of all disabling conditions in the United States.

Chief speaker at the closing dinner, March 22, was Dr. Lowell T. Coggesshall, recently appointed Assistant Secretary for Health and Medical Affairs, Department of Health, Education, and Welfare.

The address of Mr. Mayo on the problem and the challenge of chronic illness, and Dr. Coggesshall's answers to the challenge plus seven other papers from the forum are presented in brief on the following pages.

"Chronic illness accounts for almost three-fourths of the Nation's daily sickness toll," said President Dwight D. Eisenhower in a telegram read at the opening session by Hugh R. Leavell, M.D., president of the National Health Council. The President's message continued:

"There is urgent need both for more research into such disease and for prompt and widespread application of existing knowledge. For their continuing effort to solve this health problem of vital concern to our Nation, I congratulate the agencies represented in the National Health Council."

In an introductory speech, the chairman of the forum, Theodore G. Klumpp, M.D., who is president of Winthrop Laboratories, described the forum as essentially an effort to discover the type of "gears" needed to meet the new health care demands created by the predominance of chronic illness and how best to "shift" into them. He said the forum's task lay in the realm of human engineering.

"People and institutions are finding it hard to shift gears fast enough to keep pace with the changes that new scientific discoveries are making in the methods by which we may preserve or regain health among people of all ages," he stated.

"We do not wish to discard any of our human and institutional health care machinery, for we have too little of both, but rather to think of retooling and reassembling where changes may do the most good," he said.

Dr. Klumpp cited estimates of the Commission on Chronic Illness, indicating that 28 million persons in the United States—1 in every 6—suffer from some known physical or mental impairment.

More progress has been made in the conquest of disease and the prolongation of life in the last 50 years than had been accomplished in 999 centuries of man's previous existence, Dr. Klumpp said. Life expectancy has moved upward from 49 years in 1900 to almost 70 years in 1955, and, if the population forecast is correct, he continued, 1 in every 7 persons in 1980 will be 65 years of age or older.

"That means a larger burden of the chronic illnesses, though we shall hope that new medical and surgical advances can cut down the toll," he stated.

"Dealing with the long-term illnesses requires a great deal more community cooperation and more individual initiative and understanding than it took to control the communicable diseases," Dr. Klumpp pointed out.

Recommendations for the retooling which Dr. Klumpp urged were numerous throughout the six panel discussions that made up the major part of the forum. One of the panels sought answers to whether a home care program should be hospital oriented or health department oriented, how much responsibility for the chronically ill the general hospital should assume, how the necessary integration of hospital and home care can be realized.

Two other discussion questions were: Can the total of voluntary (direct and prepaid) and public assistance payments be increased to reduce the balance of unmet needs, with all that they entail of individual suffering and human waste? How can we awaken communities to chronic illness needs? Through service and referral centers? Through studies? Through committee action?

Four priorities seemed to emerge from the

many needs for action on chronic illness brought out in the panel sessions. These may be stated as:

1. Adopting a "do it yourself" approach to health problems in order that all citizens may seek medical aid in the early detection of chronic diseases and cooperate in whatever changeover is required in each community to meet the new challenges presented by long-term diseases and disabilities.

2. Joining more closely the medical and social sciences since the effective medical care of the patient and his cooperation are to be realized only through good community organization.

3. Providing tools to help professionals and the general public understand more acutely the common denominator aspects of chronic illness so that community health services may develop the flexibility and flow requisite to care of the chronically ill.

4. Taking inventory of the sickness in the Nation and what is needed in the way of additional services and planning.

Samples of the forum's advice may be drawn from the experiences reported to the panel on "Community Action Together." The panel was moderated by Charles H. Brasuell, executive director, Pennsylvania Health Council. Three

### Coordination of Communication

In the hope of encouraging speakers to say what they really mean, rather than repeat ritualistic phrases or shopworn words which have lost their original market value, one panel agreed that a fine would be levied for what James Thurber has satirized as "the gangrenous repetition of threadbareisms." Specified examples included "cooperate," "integrate," and "coordinate," as well as "area" and "level of action." Fines ranged from 5 cents for abuse of "impact" and 10 cents for "field" to 25 cents for "in terms of." The fine for "integration into the basic health structure" was remitted for a speaker who used the phrase at the right point. Panel members so well voiced their thoughts that receipts were zero.

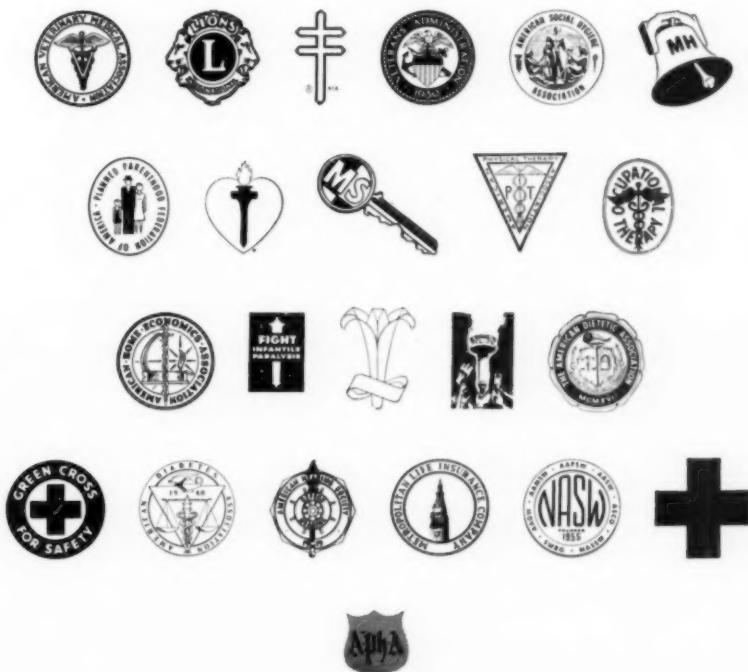
of these experiences are distilled in the following statements:

- A study of community chronic illness can be an instrument to effective action, but if not wisely planned, it can prove to be an obstacle.
- Participation of physicians in any community program for the chronically ill is of key importance.
- People who cannot understand vague references to "the chronically ill" will listen to specifics; for example, "Mrs. Brown is taking Hope Hospital's homemaker service to old Mr. Attarian each day."

Other panel moderators were Arnold B. Kurlander, M.D., chief, Chronic Disease Program, Public Health Service; Cecil G. Sheps, M.D.,

executive director, Beth Israel Hospital, Boston; George Bugbee, president, Health Information Foundation; G. D. Carlyle Thompson, M.D., executive officer, Montana State Board of Health; and Leona Baumgartner, M.D., New York City health commissioner and incoming president of the National Health Council.

Next year's forum will consider mental health, in its broad implications for all organized health effort. To be held in Cincinnati, March 20-21, it is part of a plan to rotate the annual forums of the council throughout different areas of the United States. Basil O'Connor, president of the National Foundation for Infantile Paralysis, was chosen president-elect of the council.



Symbols of some of the participating organizations of the National Health Council.

## Five Million People



Chronic illness is the challenge of this era to hospital, public health, medical, nursing, and all the professional services concerned with sickness and disability. It is a golden opportunity in the golden age of medicine.

The challenge of chronic illness is seen in the lives of all those who are adversely affected physically, socially, and economically, and particularly in the lives of the estimated 2 million adults who, though now idle, could become employable and tax paying if provision were made for their rehabilitation. More than 90 percent of these persons could be brought to complete economic self-sufficiency if adequate facilities for rehabilitation were available to them. The Office of Vocational Rehabilitation of the Department of Health, Education, and Welfare has an extended program with this objective in mind.

The problem of chronic illness—much better defined as long-term illness—is illustrated by the hard core of nearly 5½ million people in the United States with chronic disabilities sufficiently serious to require some form of care. It is illustrated daily by the continuing struggle maintained at an appalling cost in dollars, depleted energy, and lives against the cardiovascular diseases, responsible for more than half of the deaths in the country; against cancer, which kills a quarter of a million Americans annually; against mental illness, which brings three-quarters of a million people under

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*By Leonard W. Mayo, chairman of the Commission on Chronic Illness and director of the Association for the Aid of Crippled Children, New York City, who summarizes in brief the principles and recommendations of the commission, to be published soon in a four-volume edition. A midway report on the work of the commission appeared in the March 1954 issue of Public Health Reports, p. 295.*

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some form of hospital care in the course of every 12 months; against arthritis and rheumatism; against blindness and deafness; against epilepsy, tuberculosis, multiple sclerosis, Parkinson's disease, diabetes, cerebral palsy, and various eye disorders. In short, these diseases and handicaps account for 88 percent of all disabling conditions in the United States.

### Commission on Chronic Illness

The Commission on Chronic Illness, composed of nearly 50 interested and knowledgeable citizens and some 30 technical assistants, and served by a highly competent staff, was founded in 1950 by the American Medical Association, the American Hospital Association, the American Public Health Association, and the American Public Welfare Association to help define, identify, clarify, and classify the problem of chronic illness.

The commission has defined chronic illness as comprising "all impairments or deviations from normal which have one or more of the following characteristics: are permanent, leave residual disability, are caused by nonreversible pathological alterations, require special training of the patient for rehabilitation, may be expected to require a long period of supervision, observation or care."

The commission was dissolved [in June 1956]. It therefore remains for other organizations to go forward with extensive programs designed to meet the problems of chronic illness.

—LEONARD W. MAYO

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Chronic illness is no longer the exclusive and private business of the patient and the healing professions. It is a matter of public concern in an age when, for humanitarian reasons and for reasons of defense, the Nation is more conscious than ever before of the need for conserving human resources. In such an age, illness, disability, and preventable death are problems the whole community must comprehend and help solve. The time-honored confidential relationship between the physician and his patient has limited value unless it is supported

and enhanced by the presence in the community of adequate treatment facilities. Hospitals, clinics, nursing homes of high standard, and like facilities come only as the direct result of citizen interest and community action.

Of the nearly 5.5 million victims of long-term illness, 2.1 million are 65 years old and over, 1.8 million are between 45 and 65, and 1.4 million are under 45. These figures and the record of the rehabilitation of chronically ill persons should put to rest the common misconception that chronic illness is synonymous with old age and generally incurable. The rate of chronic illness in relation to age is, however, significant. It is 1.3 percent for those under 45, 5.8 percent for those between 45 and 64, and 17.1 percent for those 64 years old and older. Disabling illness is 13 times as great for those 65 years of age and beyond as it is for those under 45.

#### Principles and Recommendations

The Commission on Chronic Illness has evolved a number of basic principles and a series of recommendations as a result of important studies, fact finding surveys, and research. It is both timely and appropriate to list a few of the most germane.

First, as to the individual patient himself—his needs, his rights, his personality are paramount. His needs cannot be met, nor his rights properly recognized, nor his personality fully respected, however, unless he is treated as a whole person. If he is regarded thus, his rehabilitation or restoration will inevitably include the services of many professions and disciplines.

When more than one profession is involved, there arises the need for wise planning, skillful cooperation, and harmonious interplay among the representatives of each profession. This is, in essence, the team, currently a popular concept but not yet fully understood or too effectively practiced.

In this integrated approach to the treatment of chronic illness, perhaps the strongest factor is our knowledge and treatment of the purely

physical aspects, and the weakest is that of the social and emotional factors. We have considerable security in dealing with the former, but something less than that in dealing with the latter.

Recognition should therefore be given to the importance of the emotional attitude of patients whose illnesses become long drawn out, permanently crippling, or in other ways a major frustration. These attitudes embrace morale, motivation, and mood. Personnel in institutions, in the home, and the patient's family must constantly seek to help the patient endure pain, delay, and disappointment; faithfully follow difficult treatment regimens; keep hope alive; maintain a will to live; and develop a philosophy of acceptance as part of a mature faith.

Care of the chronically ill is inseparable from general medical care. While it presents certain special aspects, it cannot be medically isolated without running serious dangers of deterioration of quality of care and medical stagnation.

Care and prevention are inseparable. The basic approach to chronic disease must be preventive, and prevention is inherent in adequate care of long-term patients.

Rehabilitation is an innate element of adequate care, and the process properly begins with diagnosis. Rehabilitation is applicable alike to persons who may become employable and to those whose only realistic hope may be a higher level of self-care. Not only must formal rehabilitation services be supplied as needed, but programs, institutions, and personnel must be aggressively rehabilitation-minded.

With full appreciation of the necessity for adequate institutional facilities, and with the realization that some areas lacking in such accommodations should provide them, the commission feels that henceforth communities generally should place the greater emphasis on planning for care in and around the home.

Hospitals, outpatient departments, health departments, nursing organizations, and others furnishing the specialized services required by the long-term patient should reexamine their policies and practices to assure for him the best modern medical care.

Adequate care of the long-term patient requires arrangements which promote frequent evaluation of the patient's needs and easy flow back and forth among home, hospital, and related institutions.

Coordination and integration of services and facilities are a must in promoting good care for the chronically ill.

No pattern for organizing services is satisfactory for all communities. Programs must of necessity be tailored to fit local situations, taking full account of what is good in existing resources for care at home or in an institution. Planning should be based on facts—both local and regional—as to needs, density of population, financial capacity, and types of illnesses and accidents likely to prevail.

Planning and programs must be directed to the needs of all long-term patients, and not limited to the needs of any special economic, racial, cultural, or other segment of the population.

Personnel shortages in the professions concerned with the chronically ill constitute a major block to improvement of care. The number of personnel must be increased by recruitment, assistance with the costs of education, attractive salaries, and other inducements. This is particularly applicable to personnel associated with physicians in patient care.

The cost of programs to provide care to long-term patients should be measured first as to human values of effectiveness, then as to productivity. The most economical care is that which returns a person as quickly and as fully as possible to the highest attainable state of health and social effectiveness.

The primary function of philanthropy in financing long-term care should continue to be that of strategic investment of venture capital. Philanthropy should play an important role in financing the coordination of community facilities and should lead the way in the provision of more adequate care through research, demonstration, and experimentation.

Public financing of medical care for long-term indigent and medically indigent patients is inadequate in most communities, whether for long-term or short-term general hospital care, mental and tuberculosis hospital care, nursing-

home care, rehabilitation services, or care at home.

Increased amounts of public and private funds must be devoted to measures to coordinate the services needed by long-term patients.

Private and public expenditures for research should be expanded.

A vigorous program of public education should be launched to stimulate the achievement of the recommendations for financing outlined herewith.

Investigations of diseases and their origins and studies of the needs and responses for maintaining and improving health should command high priority in the spending of research funds. To increase and extend the application of knowledge gained from research, laboratory and clinical investigations must be correlated with intensive and extensive research designed to measure the dimensions of the chronic disease problem and to reveal the most appropriate and effective methods and procedures for meeting those problems.

#### **Checklist for Any Locality**

The effective application of these principles, policies, and philosophy to local communities is basic to meeting the challenge of chronic illness in the United States. An area of 100,000 population, for example, may expect to have 3,500 persons needing long-term care. More than three-fourths of these persons are in their own homes, yet they may need some form of help from a community service at some time.

If a community does not have a committee now studying problems of chronic illnesses as a whole, such a committee should be organized. It could be set up on a town or county basis. It should be composed of both professional health leaders and representatives of other professions as well as business, industry, and labor. It should be developed in cooperation with medical and dental societies, the council of social agencies, the health council, and the health department. Three first steps for such a committee would be to:

- Study the total problem of chronic illness in the area and, with the help of a small staff, bring together facts on the extent and character

of various types of existing resources for care.

- List the kinds of needs represented in a cross section of the people in the town or county who have been ill or handicapped for a period of time—medical, educational, vocational, social needs, and the like—and the kinds of services, facilities, and personnel required to meet such needs somewhere near adequately.

- Determine how a unified program to meet the needs should be financed and administered.

The services and facilities that a typical town or county should expect to develop in about 10 years might be something like the following checklist. It can be adapted to any size community.

*A diagnostic, evaluation, and classification center.* The center should be located in a hospital if at all possible and should sustain close relations with all hospitals in the area. With the cooperation of the private physicians and hospitals who refer cases to it, the center should provide full diagnostic and evaluation service for the chronically ill and the handicapped.

*Counseling and employment service.* The service should probably be a part of the diagnostic and evaluation center, though it would be closely related to the board of education and the council of social agencies as well. It would furnish educational, vocational, and employment guidance.

*Treatment facilities and services.* Every county should have at least the following facilities and services for the benefit of all chronic patients residing in the area.

1. Medical and dental societies interested in the problem of the chronically ill.

2. Adequate public departments of health and hospitals.

3. A program of home care (many chronic patients now in hospitals and nursing homes can be cared for at home with the aid of housekeeper service, public health nurses, and hospital personnel).

4. Licensed nursing homes under public or private auspices or under both and closely related to the hospitals.

5. A private or county hospital or a wing

exclusively for chronic patients requiring hospital care for a protracted period.

6. Home industries and educational programs for persons who can carry on a limited amount of work or study at home.

7. Sheltered workshops and special educational classes for adults, children, and young people who cannot meet the demands of regular employment or school.

Along with these services and facilities, there should be sufficient flexibility and fluidity so that a patient may move from one service to another as his condition changes. Thus, a patient might be referred to the diagnosis and evaluation center, be sent to the hospital for the chronically ill, move on to a nursing home if his condition so indicates, go later to his own home, thence to a sheltered workshop, and finally to regular employment if rehabilitation is relatively complete.

It is this dynamic element or movement quite as much as the accession of needed services and facilities that will mark the community and hospital efforts of the next decade as differing from those we have known.

The costs of such a program will not be entirely met by salvaged lives and earning capacities, and by the elimination of duplicating and unnecessary services. Yet, in due course, citizens will find that under a modern dynamic program the number of persons rehabilitated and returned to full or partial employment will go a long way, over a period of time, toward meeting the extra cost.

The words of Thomas Mann suggest the philosophy that should guide us: "Let us think like men of action, let us act like thoughtful men."

## Public Programs

**PHR**  
brief

The challenge and the problem of chronic disease and disability concern the entire Department of Health, Education, and Welfare—involving to some extent the Social Security Administration, the Office of Education, the

Office of Vocational Rehabilitation, the Food and Drug Administration, Saint Elizabeths Hospital, as well as the Public Health Service.

Because of a lack of basic data it is impossible to define the magnitude of the problem accurately. Excellent specific studies have been made in a few areas since the last nationwide data were compiled in 1936. But these are all too few, and there is no compilation for the country as a whole. If the proposed continuing, national sampling survey of disease and illness is approved, the Public Health Service will derive statistical estimates of the extent of the major diseases, injuries, and impairments. Estimates will be made of the nature and duration of the resulting disability and of the amount and type of medical and related services received.

Scientific research is fundamental in meeting the problem of chronic disease and disability. Thanks largely to science, the modern physician in a few minutes can accomplish more for a pneumonia patient with a penicillin injection than his professional predecessor could by staying up all night awaiting a crisis.

It is significant that—in spite of the new chemotherapeutic agents and antibiotics, improved diagnosis and surgical techniques, extensive use of blood plasma and parenteral fluids, and the steadily increasing emphasis and effectiveness of preventive medicine—our statistical trend of increasing longevity is not fully maintained after we pass the middle age brackets.

Although there has been some improvement in mortality toward the end of middle life, it has been relatively small, and in old age it has been imperceptible. In the United States the decline in mortality for men over 40 has not kept pace with the corresponding decline for men in Canada, Australia, New Zealand, and in most of the countries of northwest Europe.

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*By Lowell T. Coggeshall, M.D., Special Assistant for Health and Medical Affairs, Department of Health, Education, and Welfare.*

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Several explanations have been advanced as to why life expectancy among the older age groups has not increased more rapidly. None has been adequately tested. I will dismiss this subject for the moment with this question: Does the youngster who survives a deadly infection, thanks to an antibiotic, have a lessened tolerance to cancer, heart attack, or some other degenerative disease in later life?

We know that people over 65 have almost twice as many disabling illnesses as those between 16 and 64. Moreover, they respond less rapidly to treatment or care, usually requiring twice as much time for satisfactory response.

#### **Knowledge and Practice**

Uppermost in the thinking of the Department has been the fact that the burden of chronic disease and disability falls so heavily on older people. However, we deem it unwise to attempt to limit research to what might be commonly regarded as problems of the upper age groups.

The most important discovery for the health of older patients could well come from a study in pediatrics. More fundamentally, a finding in biochemistry, physiology, or genetics may need only minor variations—or none at all—to be applied to conditions prevalent among patients of a given age.

Through basic and clinical research, progress toward effective treatment of some chronic illnesses has been rapid in recent years. Many patients formerly considered incurable can now be cured or their lives prolonged. Although medical research is making encouraging progress, any attitude other than an aggressive one toward further progress would be inconsistent with our beliefs. We must not make the mistaken assumption, though, that providing unlimited funds will solve any research problem. To the contrary, we must acknowledge that research progress will be limited always by at least three factors: facilities, trained manpower, and, above all, ideas.

Fortunately, private philanthropy and public funds have provided strong financial support for research into many major medical disorders. Unfortunately, however, much of the

physical plant now used for medical research was designed or built at the beginning of the century. It is not satisfactory for modern health research.

Even if unlimited sums were suddenly made available for medical research, and satisfactory physical facilities existed in which to conduct expanded research, I doubt that progress could be accelerated in the face of a shortage of adequately trained, properly paid, young people. Too many talented young men and women in the health professions leave teaching assignments, research laboratories, health departments, and hospitals because of financial pressures. Of course, we all recognize that dedication is a prime requisite for a health practitioner. But financial sacrifice need not be an essential requirement for a career in health.

Now, if we have adequate facilities, ample research funds, and sufficient talent, we can make enormous progress by developing a steadily increasing program of basic and clinical research. In my own association with the cancer program over the past few years, primarily as an administrator, my attitude changed gradually from real scepticism to conservative optimism. This change came about largely because scores of the best scientific minds are now attacking the problem with fervor and support. Yet, a few decades ago many talented workers felt that the approaches to basic research in cancer were so unpromising as to hold little hope of solution.

Although full knowledge of the cause of many chronic disease entities appears to be far in the future, substantial progress toward their control is now possible. There must be greater emphasis on efforts to translate present knowledge into improved medical and public health practice. Much more is known about chronic disease and disability than is being applied. We must demonstrate especially that they need not be accepted as inevitable among the older age groups.

Primary preventive techniques, as that term is generally understood in public health, are now feasible for some types of congenital heart disease, for secondary hypertension, syphilitic

heart disease, and rheumatic heart disease. Preventive measures may now also be taken against those forms of cancer in which environmental hazards are believed to be contributory or precipitating as well as against certain precursors of cancer.

Among the neurological disorders, it is already possible to institute primary preventive procedures to control cerebral palsy. Much blindness is preventable. Controlled use of oxygen will prevent retroental fibroplasia among most premature infants who require this aid. Ophthalmia neonatorum and uveitis are preventable through control of the causative agents. Congenital cataract can be prevented among some patients. Avoiding the use of certain mydriatics during examination of the eyes of older people will prevent glaucoma.

#### **The Steps Forward**

It is not unreasonable to ask why, since we know the preventive measures needed, we do not proceed at once to take the actions indicated. It may fairly be said that preventive action against chronic disease is under way already—by millions of people in thousands of communities.

Even the casual newspaper reader or television viewer is aware that syphilis and tuberculosis, are, broadly speaking, preventable. The public is learning that maintenance of desirable body weight will contribute to the prevention of diabetes, hypertension, and heart disease. The increasing popularity of long weekends and vacations would indicate, apart from economic factors, that some notion of proper balance between exertion and rest is spreading. On the other hand, the rate of accidents—on the highway, at work, and at home—would indicate either inadequate educational or preventive efforts or, perhaps, both.

The seriousness of neurological and mental disease is now gaining recognition, in terms of statistical prevalence, economic burden, and human misery. Nearly 1 person in 10 can expect to be hospitalized for a mental illness during his lifetime. Mental patients occupy a little less than half of the Nation's hospital

beds. Two patients are admitted to a mental hospital for every patient discharged. Nearly a third of those admitted to the best mental hospitals never return to the community. As much as one-third of the operating budget in some States is devoted to care of the mentally ill.

The National Mental Health Act of 1946 gave Federal support to the development of research, training, and community services. The Joint Commission on Mental Illness and Mental Health, under authority of the Mental Health Study Act of 1955, is making an objective analysis of the prospects in improved methods of care, treatment, and rehabilitation of mentally ill patients.

The expansion of the State-Federal program of vocational rehabilitation through the 1954 amendments to the Vocational Rehabilitation Act is a heartening development in the health field. Vocational rehabilitation is no panacea, nor is it relevant to the needs of many chronically ill patients. But the effect of the previously inadequate level of financial support for the program was to deny its benefits to about three-fourths of the people who could make good use of the service. The downward trend in the proportion of handicapped men and women returned to self-reliance and self-support has now been reversed.

Enactment of the Medical Facilities Survey and Construction Act of 1954 is providing financial assistance to the States for additional chronic disease facilities, outpatient diagnostic and treatment centers, nursing homes, and rehabilitation facilities.

Despite the efforts being made, progress in chronic disease control seems disappointingly slow when compared with the relatively rapid control achieved with certain acute communicable illnesses. Perhaps the halting pace of chronic disease and rehabilitation programs stems from the intrinsic nature of the problems. They are inherently different from the public health problems of the past, which were susceptible by their very nature to efforts by a few in behalf of the entire community.

Previously, the individual assumed little responsibility for public health services—for

water purification, pasteurization of milk, enforcement of pure food and drug standards, immunization procedures, and the like. This is not to assert that continued progress can no longer be made through environmental control. Rather, in contrast to the era of environmental controls, we are moving into an era of public health in which individuals themselves must assume more responsibility for protecting their own health.

Community casefinding techniques can locate undiscovered diabetes, and practicing physicians and dietitians can prescribe for and instruct the patient. It is the diabetic patient himself, however, who must use the insulin and watch his diet and exercise. The cardiac patient alone is ultimately responsible for following his physician's instructions concerning digitalis, diuretics, and low-salt diets. The health of these patients is, to a considerable extent, in their own hands. The chronic diseases and disabilities are thus more a problem of the individual than of the community. They cannot be controlled without the understanding, motivation, and co-operation of the individual citizen. This will require new approaches in health education.

Few members of the general public are consciously aware of this fundamental shift in the nature of the hazards to their health. Many, however, do understand the economic consequences of this relatively recent change in health and medical care.

Chronic disease can be catastrophic to family finances. The costs of hospitalization, physicians' services, nursing care, and drugs can be overwhelming. A great need, therefore, is for better insurance protection against the financial risks of long-term illness and other expensive diseases.

To be sure, more than 100 million Americans now have some form of voluntary health insurance protection, but there are important gaps in coverage. Too few retired persons are protected. Only 4½ million people have major medical expense insurance although this form of protection is growing rapidly. Clearly, a great deal remains to be done to strengthen

voluntary health insurance, especially as it relates to long-term illness.

It is relatively easy to foster understanding of the need for individual protection against the costs of medical and hospital care. It is not simple, however, to elicit lasting motivation for the maintenance of good health. It is especially difficult to achieve the effective cooperation that is so clearly called for by the challenge of chronic illness. The physician, the professional nurse, the public health engineer, the medical social worker, the veterinarian, the chemist, the bacteriologist, and the statistician are all needed in this task. More important, the businessman, the legislator, the housewife, the teacher, and the newspaperman—the whole community—must lend a hand to the health worker.

The control of chronic illness and disability thus presents a dual challenge. The arduous quest for cause and cure offers a greater intellectual challenge than any hitherto known to the sciences of public health. And interdicting the causes and introducing the cures into everyday lives brings public health its ultimate challenge and responsibility—that of imbuing every individual with the knowledge and wisdom he needs to make his allotted years healthful, satisfying, and productive.

## Preventive Action

**PHR brief** In the joint statement, Planning for the Chronically Ill, issued in 1947 by the American Hospital Association, American Medical Association, American Public Health Association, and the American Public Welfare Association, this statement appears:

"The basic approach to chronic disease must be preventive. Otherwise the problems created by chronic diseases will grow larger with time, and the hope of any substantial decline in their

By Lester Breslow, M.D., chief, bureau of chronic diseases, California State Department of Public Health.

incidence and severity will be postponed for many years."

The idea that a vast amount of chronic illness can now be prevented is still new although the Commission on Chronic Illness has done much to present means of prevention and to popularize the concept. Prevention means that—

- Thousands of premature babies in the future will not be blinded by too much oxygen during their struggle for survival.
- Because of insulin hundreds of thousands of diabetic persons are now in relatively good health although only a generation ago their lives would have been snuffed out or maimed.
- A simple, inexpensive test for detection and effective treatment makes it possible for thousands of women each year to be spared from having cancer of the cervix.
- Americans are more alert than ever before to the possible causes of lung cancer, which now accounts for 4 percent of all deaths among men.
- The Salk vaccine may prevent a high proportion of paralytic poliomyelitis.
- Serious rheumatic heart disease is preventable by prophylactic medication, as are many acute diseases which may produce chronic effects.

The Commission on Chronic Illness has listed more than 50 chronic diseases against which preventive action is possible.

### Primary and Secondary Prevention

Prevention includes measures which avert the occurrence of disease and measures which halt or retard the progression of disease into disability or death. These two major goals of prevention are classed as primary and secondary prevention.

Primary prevention means keeping a disease from occurring. For example, we prevent silicosis of the lungs and chronic lead poisoning by industrial hygiene.

In the primary prevention of chronic illness, effective nutrition is a major immediate goal. Millions of older people in this country subsist

on diets which are inadequate in protein, vitamin C, and other essential nutrients. They suffer impaired health because of lack of education in dietary matters, poor dentition, or low income, which keeps them from purchasing certain important foods.

On the other hand, many people are overweight, with resultant excessive mortality from cardiovascular disease, diabetes, and other chronic diseases, thanks to a generous diet, ease, and lack of physical exertion.

Popularization of optimum diet and optimum weight would carry us a long way toward primary prevention of chronic illness.

Secondary prevention means halting the progression of a disease in its early stages. For example, we find early glaucoma, a condition of hardening of the eyeball, by a simple test, and prevent blindness through treatment.

Major advances in the secondary prevention of chronic illness have been the development of simple, inexpensive tests for early detection of many diseases and the assembling of a battery of tests for screening large groups of apparently well people.

The chest X-ray for tuberculosis and lung cancer, hemoglobin and blood sugar tests, cytology tests for cancer, especially cancer of the cervix, tonometry for glaucoma, height and weight determination, and vision examinations are practical tests for the early detection of chronic disease. Combining the tests into a multiphasic screening battery to test large groups of people appears to be the most feasible means for health departments to accomplish large-scale prevention of chronic disease.

Multiple screening is steadily gaining popular support because it uncovers many cases of previously unrecognized and important diseases. The technique provides an excellent opportunity for health education. It develops and strengthens the patient-physician relationship by referring individuals to their physicians for necessary care. It is inexpensive, as low as 12 tests for \$5.

#### Epidemiological Study

Research is another important aspect of the

prevention of chronic illness. Needed perhaps most of all is epidemiological study of chronic disease. For example, why does coronary heart disease cause about 25 percent of all deaths in the United States today—more than in any other country of the world—even when we take into account the age distribution of the population? Patient, epidemiological study will help unravel the answer.

We also need research to improve and expand the array of tests for multiple screening.

State and local health departments, working with the medical profession, voluntary health agencies, and many other community groups, are now gaining the experience necessary to carry through the next great achievements in preventive medicine—the prevention of chronic illness.

## National Health Trends



In little more than a decade, medical research has made a major contribution in adding 5 full years to life expectancy at birth. But this gift of added years is a gift of years heavily weighted by chronic illness. With the conquest of the diseases of early life, more people are surviving to the ages when cancer, heart diseases, or other chronic illnesses are most prevalent. That the chronic diseases still unconquered tend to be those associated with aging takes on even greater significance for the future whenever higher proportions of our population will be aged.

Economic security and the maintenance of income have a close relationship to the problems created by chronic illness. Many of the chronically ill cannot work at all. For others, income is reduced, or the period of productive employment is lowered. No threat to eco-

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*By Charles I. Schottland, Commissioner of Social Security, Department of Health, Education, and Welfare.*

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nomic security can be greater than that of long-term illness. Nothing eats away retirement income and lifetime savings more effectively than does a long, expensive sickness.

### **Social Security Program**

Let us take a look at the present public income maintenance programs and assess future trends in relation to the problem of chronic illness.

Most people who reach old age today are assured of at least a minimum income through the program of old-age and survivors insurance. During 1956 more than \$5½ billion will be paid out in benefits. Beneficiaries now number 8 million persons, including 6½ million aged.

We can confidently predict that more and more of the aged reaching retirement, or forced out of employment because of age or illness, will be assured of some income through old-age and survivors insurance. Others will have basic financial security through our public assistance programs. Planning in the field of chronic illness can, therefore, safely be predicated on the aged and chronically ill having at least minimum income. But assurance of a basic income is only one line of attack. What are we doing about their other problems?

The public assistance rolls include many persons with serious health problems. Of the 2½ million recipients of old-age assistance in the United States, some half million are bedridden or have some impairment which requires substantial care.

Almost 250,000 persons receive public assistance for the permanently and totally disabled. More than 100,000 receive aid to the blind. In addition, some 450,000 persons receive aid to dependent children because of the physical or mental incapacity of a parent.

Thus, nearly 1½ million people receive State-Federal assistance because of need attributable primarily to disability, chronic illness, or the severe infirmities of old age. Furthermore, a high proportion of the 2 million recipients of old-age assistance who are able to care for their own daily needs have health and other problems relating to aging.

Although persons are eligible for old-age assistance at 65, the average age of the 2½ mil-

lion recipients is 75. The typical recipient has been described as a widow aged 75, living alone in her own quarters, able to care for herself. If long-term illness strikes, as is likely at her age, expensive institutional care or special home care arrangements are almost inevitable.

### **OASI Beneficiaries**

The beneficiaries of old-age and survivors insurance (OASI) are representative of the health problems of the aged in their retired years. It seems worth while, therefore, to review some of the findings of our national survey of aged beneficiaries in 1951.

They spent an average of 2¼ days during 1951 in general hospitals. They were incapacitated in other institutions for a little more than 1 day. They spent another 12½ days confined to bed at home. The total is approximately 16 days of more or less complete incapacity. It excludes the days when, despite heart conditions, arthritis, or other degenerative ailments, the beneficiaries were up and around.

One in twenty-five reported bed confinement at home or in a hospital or institution for 14 weeks or longer during the year. Incapacity of this duration has a serious impact on the general well-being of the family unit even when no hospitalization expense is involved.

One in every 250 was incapacitated in an institution other than a general hospital for an average of almost three-fourths of the year. More than half spent a full year in such institutions. Most of this care was financed at public expense.

About two-thirds of the total number of days of institutional incapacity was in mental hospitals, tuberculosis sanatoriums, veterans hospitals, or county or city infirmaries—in institutions that depend on public financing even though some patients may be charged on an ability-to-pay basis. Even for the OASI beneficiaries in proprietary nursing homes, an element of public financing was often present in that a public assistance agency was underwriting the bill.

Although less than 1 in 4 had hospitalization insurance, the proportion was significantly higher for those recently retiring than for those

who had come on the OASI rolls in the early years of the program. This indicates growth of voluntary health insurance will help to overcome the problem of financing care of the chronically ill.

The beneficiaries covered by hospital insurance averaged more days in general hospitals than did those without protection against illness costs: 2.8 days in contrast to 2.1. This difference is significant in the light of the lower average number of days of incapacity of all kinds for beneficiaries with insurance: 12.7 days in contrast to 16.6 days. It indicates the effect of prepayment in removing the cost barrier to hospital care.

#### Outlook for Health

From other sources, we know that an increasing proportion of the population will be able to continue their insurance against hospital and medical costs after retirement. This is hopeful, but there is still a long way to go. While about two-thirds of the population under 65 now have some form of prepaid hospitalization insurance, fewer than 1 in 3 of the aged have this protection.

We see growing concern for the medical care problems of public assistance recipients. The characteristics of recipients are such that we can assume they will in greater degree continue to need long-term care outside their own home. The 1950 census indicates that between 1940 and 1950 the number of persons aged 65 and over who were living in institutions other than general hospitals rose twice as fast as did the total aged population.

The largest relative increase in institutional care took place in homes for the aged and in nursing homes. This factor will add to the cost of medical care as a component of public welfare costs. Efforts of licensing and standard-setting authority, to which the 1950 Social Security Act amendments gave a long-needed impetus, and efforts of nursing-home operators to raise standards can be successful only if better financial support and more adequate personnel are forthcoming.

Our medical research efforts have been tre-

mendously strengthened, and further expansions are proposed. We must also increase our speed and efficiency in applying these findings to the treatment of patients and to our public health preventive programs.

The 1954 amendments to the State-Federal hospital construction program opened up new opportunities for the construction of chronic disease hospitals, nursing homes, diagnostic and treatment centers, and rehabilitation facilities.

I do not need to emphasize the importance of making hospital beds available to the chronically ill in special hospital wings, in nursing homes, and in facilities geared to long-term care and costing the patient much less than care in short-term hospitals. But I do want to point out that it would be unfortunate if methods whereby people pay for long-term care were to lag seriously behind the expansion of suitable facilities.

One hundred one million people in this country now have some form of insurance against hospital costs. Only a fraction, however, have insurance that covers nursing-home care or that is flexible enough to extend the days insured when costs per day are reduced.

A long stride forward was the recognition that there are other and better ways of caring for the chronically ill than in a hospital bed. We are seeing impressive demonstrations of what can be achieved through home care programs designed to provide the most suitable care for the invalid, in many instances at lower cost. Our progress is dramatically demonstrated when older people who have spent long years in mental hospitals are returned to normal existence and happy adjustments in their own communities. Care at home costs much less than care in a specialized hospital, and a bed is released for a younger patient who can be returned to productivity.

It would be folly to think that we can solve mental health problems by a wholesale exodus from mental institutions. But there is evidence that, through improved methods of care and treatment, the average length of hospitalization for mental patients can be materially reduced and a great deal of mental illness can be pre-

vented. The Mental Health Study Act of 1955 has made an important start in this direction.

Using another line of attack on chronic illness, the State-Federal programs of vocational rehabilitation are demonstrating that many individuals handicapped by chronic illness can be restored to productive work.

To take heart disease as an example, the Office of Vocational Rehabilitation has granted funds for research into the rehabilitation problems of persons with heart disease; has provided grants-in-aid and technical advice to State rehabilitation agencies which, in turn, offer counseling, physical restoration, and job placement services; and has encouraged the establishment of local work evaluation units for heart patients.

For the 2,500 heart disease sufferers restored to productive lives through the program in 1955, earnings after rehabilitation were 15 times as great as earnings at the time of applying for rehabilitation services.

Children, too, have a direct stake in the fight against chronic illness. With the assistance of Federal funds, the States have made great strides in extending and improving services for promoting the health of mothers and children. Through prenatal clinics and well-child clinics, and through the provision of health examinations, nursing services, and immunizations, the younger population is equipped with its greatest weapon against chronic illness—a healthy start in life.

The crippled children's program locates children in need of care and provides the means of restoration through diagnosis, medical and surgical treatment, and the alleviation of unfavorable social and psychological influences that increase the degree and duration of disability. Through grants provided for special projects of regional or national significance, the benefits of medical research and new techniques have been made available to children with congenital heart disease who live in rural areas where highly specialized care is lacking.

This view of the future would have had better perspective if we were able to focus against a background of reliable data on the extent of illness and disability.

## Illness Absenteeism



Five years ago the Research Council for Economic Security undertook a nationwide survey on prolonged illness-absenteeism among employed persons. The survey includes 6,200 cases of nonoccupational disability only. Analysis of the data and the summary report will be ready for publication later this year. In the meantime, by reviewing the results of a subsample, which represents the illness-absence experience of some 80,000 man-years during which approximately 3,000 absences of more than 4 consecutive weeks each were reported, I can indicate what some of the findings are likely to be.

### Meeting the Costs

The average gross medical care cost incurred by the absentees was some \$360, but in about one-fourth of the absences medical care cost more than \$500. The largest share was spent for hospital services. A little more than one-third was spent for physicians' fees. Almost 60 percent of the fees were for surgical services.

The extensive development of employee benefit plans in recent years is reflected in the subsample. The employing establishments all had some kind of medical care plan. As a result, 88 percent of the absentees received some benefits to help pay these costs. The others, who either were not members of the group plan or were not hospitalized, used medical services not covered by the plans.

Major emphasis in all of the plans is on hospitalization and indemnity payments for surgical procedures. Very few provide benefits for nonsurgical medical services in the hospital. Even fewer provide benefits for medical care costs incurred outside the hospital.

The benefits received covered almost 77 per-

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*By Gerhard Hirschfeld, director, Research Council for Economic Security.*

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cent of the hospital charges and about 57 percent of the surgeons' fees but met only 10.5 percent of all the remaining medical care costs. The total benefits received paid for about 54 percent of the gross medical care costs. Some 31 percent of the absentees had other insurance coverage from which they drew some benefits.

The average net medical care cost—after deducting all benefits from insurance sources—was \$157. The average net cost for absentees in the higher income groups was somewhat greater, but it was not materially less for those in the lower income groups. This meant that a higher share of their earnings went for the medical costs.

For absentees whose annual earnings totaled less than \$3,500, and the largest number were in this group, the average net medical care cost incurred during their absence was \$138. The average net medical care cost for the single absence of the average wage earner was 5.5 percent of his annual earnings. For the absentees earning between \$3,500 and \$5,000, it was 3.7 percent. For those earning more than \$5,000, it was 3.3 percent.

To the medical care costs must be added the loss of the wages that might have been earned. Ten weeks was the average duration of absence, and \$800 would represent the average gross wage loss.

Again, the extensive development of employee benefit plans is reflected in the fact that 86 percent of the establishments had either sickness compensation or sick leave plans. Many had both. Of course, no insurance plan seeks to provide benefits equaling the full wage loss. These plans, too, like the hospital and surgical programs, are focused on the short-term disabilities. As a result, though they succeed in reducing the wage loss that absentees might have incurred, they succeed only to the extent of paying 43.5 percent of the wages the employees might have earned. The average net wage loss was about \$450.

Adding this wage loss to the average net medical care cost, we find that the average prolonged illness-absence among a typical group of employed workers represents a total

cost plus wage loss for the single absence of approximately 15 percent of the average annual earnings.

#### Financial Sacrifice

A primary objective of the survey was to get some idea about the economic impact of prolonged illness. On his return to work, each employee in the sample was asked what financial sacrifice he made to pay the cost of his illness. Here is the picture.

- 43 percent drew on savings set aside for a special purpose, such as a house, car, or household appliance.
- 16 percent borrowed money.
- 15 percent arranged to pay for the medical care on a payment plan.
- Someone in the immediate family of 4 percent of the absentees went to work to help pay the expenses of the illness.
- 2 percent sold property or other belongings.
- 2½ percent applied for assistance outside the family, from a private welfare agency, public agency, company loan fund, or the church, for example.

A number resorted to more than one of these methods of meeting the costs.

#### Key Role for Industry

We have only begun to provide coverage for long confinements in the hospital, for unusual ancillary charges, and for the services of physicians other than hospital surgeons. There is almost no coverage for institutional care other than in an acute or general hospital. The development of such coverage must, of course, await further progress in construction of adequate facilities. There are great gaps in the coverage of services and other medical costs outside institutions—to cover physicians' care in the office, in clinics, and at home; to pay for other professional services and facilities while the patient is home or for continuous care after his return to work. The latter type of coverage is of particular significance in chronic disabilities.

About half of the absentees were under 45

years of age. Certainly in this age group, a well-organized program of regular examination, early diagnosis, education, and other means, could be effective in preventing short-term illness from developing into prolonged illness.

Industry is in the best position to introduce practical measures for such a program. Prolonged illness-absenteeism may cost a company with 100 employees as much as \$10,000 a year.

## Chronic Disease Services



As a member of the Subcommittee on Chronic Disease and Rehabilitation of the Committee on Administrative Practice, American Public Health Association, I shared the responsibility of developing a manual on the health department's role in chronic disease and rehabilitation services.

In order to prepare the manual, which is nearly complete, the subcommittee found it necessary to learn about the type and extent of services being performed in health departments. Generally, we have found that State and local departments are not acting as effectively in the field of chronic illness as current professional knowledge permits even though they offer a variety of services for the chronically ill.

### State Health Departments

For reference the subcommittee used the Public Health Service publication, *Distribution of Health Services in the Structure of State Government*, edited by the late Dr. J. W. Mountin. In attempting to bring Dr. Mountin's work up to date the subcommittee con-

cluded that at the State level the widely disparate picture presented in 1950 continues in a similar manner today although more programs have been developed and more States appear to be giving attention to chronic disease services.

Today there is also a wider understanding of the fact that for a long time most State health departments have been providing services related to chronic disease. However, these services are being performed within the context of the more traditional activities.

For example, under the banner of maternal and child welfare, there are three major programs: (a) the reduction of maternal mortality, particularly in its program to control toxemia and hemorrhages of pregnancy; (b) the reduction of infant mortality with recent emphasis on the prevention of premature birth and the prevention of death from prematurity; and (c) the provisions for services to crippled children.

In other traditional areas we find rheumatic fever programs; some aspects of programs for the control of tuberculosis, syphilis, and encephalitis, and for the elimination of pellagra; increasing statistical studies in applying the epidemiological approach to the study of chronic illness; increasing attention to screening and early detection; new emphasis on health education services; and provision of certain laboratory services. In most States we find various degrees of participation in rehabilitation programs.

In summary, the subcommittee study shows a long list of types of services only a few of which, however, are carried out by, or through, more than a small number of State health departments. The broad programs of California, New Jersey, and New York are the exception. There is more service and more consistency of program in States where the State health department received the stimulation of Federal funds, both regular grants and special grants.

### Local Health Departments

Information on local health department services is derived from a subcommittee survey conducted in June–October 1955 under a contractual agreement between the American

*By G. D. Carlyle Thompson, M.D., executive officer and secretary, Montana State Board of Health.*

Public Health Association and the Public Health Service.

We questioned 271 local health departments, generally the larger ones and the ones more likely to be undertaking chronic disease services. Of the 187 replies, 60 percent considered chronic disease activities to be a major responsibility, even though less than 10 percent of the group had established a division or unit devoted specifically to chronic disease.

As one might expect, the departments which consider chronic disease a major responsibility have developed a wider variety of services, and they participate in more of the services provided by other agencies.

Few of the departments had a working knowledge of most of the other chronic disease services available in the community.

More than 60 percent had participated in some kind of community survey relating to chronic disease. About 50 percent have seen the findings put to work by the community.

Only about half of the departments maintain any kind of current morbidity data on chronic disease and disability.

In a large proportion of the reporting departments, public health nurses make use of health workers serving in a wide variety of special fields. These other workers are employed, for the most part, by agencies other than the local health department.

For example, almost 90 percent of the local health departments in the survey make use of social workers, but less than 20 percent employ such personnel directly. Almost 75 percent of the respondents use the services of nutritionists, but less than 25 percent employ a nutritionist on their own staff.

It may come as a surprise that almost 40 percent of the local health departments play a part in providing local chronic disease institutions with nutrition consultation. Obviously, some of these departments use the nutrition consultant of the State health department, either directly or through their public health nurses.

Most local departments provide for physicians or health department patients, directly or indirectly, such laboratory services as cytologi-

cal studies for cancer cells or blood sugar determinations.

However, between 60 percent and 70 percent do urine analyses for both sugar and albumin and read chest X-ray films for tuberculosis, cancer, and heart disease.

A large proportion of local departments evidence an interest in providing consultative services to local welfare agencies. Other studies by the American Public Health Association, by its Subcommittee on Medical Care, raise some questions about the extent to which such services are actually used, however.

Most of the personal health services directly administered by the local health departments in the chronic disease field are in traditional areas of public health practice, but almost half of the departments offer some kind of screening program for more than one disease entity. And a large majority claim to offer an active referral service for patients needing care not directly provided by the health department.

A small number of the departments have experimented with nutrition classes, group sessions for obese persons, and followup of diabetic patients to make sure that medical supervision is maintained. Many departments offer a regular followup service of this nature for patients with rheumatic fever or for patients recovering from acute poliomyelitis.

## Suggestions and Predictions



Chronic illness is a daily disaster. More people are living long enough to suffer from prolonged illness and disability.

The problem is acute and requires community action, but many folks consider it a technical matter, to be solved by experts in medicine, public health, and hospital administration.

*By C. Rufus Rorem, Ph.D., C.P.A., executive director, Hospital Council of Philadelphia.*

The situation probably will become worse before it gets better. The public requires a shock to awaken a sense of responsibility for action. The following suggestions and predictions are offered.

1. Chronic illness must be considered broadly. It includes disabilities resulting from advancing age, crippling injuries that can be helped by rehabilitation, and general long-term illness. The individual must learn to live with "what he has left."

2. General hospitals should be powerhouses, not storehouses, in the treatment of prolonged illness. A general hospital is not intended for perpetual care. In prolonged illnesses, the hospital serves best for intermittent periods of intensive service.

3. Home care is a desirable alternative, not a "poor relation" of hospital inpatient service. The problem of cost is important, but more important is the idea that a patient may be a hospital patient while receiving supervised care in his home.

4. Outpatient service for long-term illness will increase at hospitals. This is not incidental; it is fundamental. Services provided at a hospital conserve the time of attending physicians, who should be paid for their work to assure continuity in the personal relationship.

5. Long-term illness generally leads to economic dependency. It causes interruption of employment as well as expenses for medical care. Many persons will require public support to supplement insurance benefits and private resources.

6. Much can be accomplished through better use of existing facilities and personnel. Home care by visiting nurse societies may avoid the need for additional hospital beds. Medical services at homes for the aged can serve the health needs of many residents. Rehabilitation through physical medicine, training, and sheltered employment will restore many disabled persons to a condition of self-help or self-support. Recreational and personal services will reduce some of the illnesses attendant upon lonesomeness and boredom.

## Meeting the Costs



To an increasing extent, over the years, the medical reasons for people being on public assistance have been in the ascendency. About 43 percent of the 425,000 public assistance recipients in the State of New York in December 1955 were indigent because of a chronic illness or disability. This number included about 100,000 receiving old-age assistance, 40,000 receiving aid to the disabled, 4,000 receiving assistance to the blind, plus about 20 percent of the family heads of the 200,000 aid-to-dependent-children families and of the 80,000 home relief units. Considering all family units as individual cases, we estimate that 73 percent of the 225,000 cases on the public assistance load are there because of long-term illness.

In 1951 the average monthly expenditure for medical care for each public assistance recipient was \$3.88 as compared with an average monthly grant for all other purposes of \$39.35. In 1954 it was \$7.94 compared with an average of \$41.62 for all other purposes. The figures for medical care include physicians' services, hospital and infirmary care, drugs, nursing and physical therapy services, and laboratory services. Private nursing-home care is excluded.

The cost of hospital care accounts for a large part of the doubling of medical costs over the past 4 years since most welfare districts pay for hospital services on a per diem basis of actual costs, and, as everybody knows, hospital costs have been rising continuously.

Drug costs have become a serious problem except in the local welfare districts with rigidly controlled programs. Drug costs now comprise from 5 to 25 percent of the total costs of medical care whereas rarely did they exceed

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*By I. Jay Brightman, M.D., assistant commissioner for welfare medical services, New York State Department of Health, on detail to the New York State Department of Social Welfare.*

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10 percent in 1951. The increase is largely attributable to the remarkable advances in drug developments over the past decade.

Recognizing that the increased drug costs are largely due to the recent development of "wonder" drugs, drug audits in New York State still have indicated many areas where drug costs could be reduced by amounts varying from 10 to 15 percent. Such reductions lie in the area of greater reliability upon older drugs that are still tried and true, over which new proprietary medications have no established superiority. There is also the area in which more drugs are prescribed than the patient can possibly use without having toxic effects or without giving the drugs away or throwing them out. One gains the impression that the prescribing of drugs, the costs of which are rapidly approximating the costs of physicians' care, is a most inefficient operation.

Physicians' fees have not accounted for any major increase in total costs over the past 4 years although a 20-percent increase was allowed in 1954.

It is doubtful that much reduction in costs can be made in the hospital field except for greater awareness regarding the discharge of chronically ill patients to less costly places which can provide adequate care, mainly, to nursing homes and infirmaries, and to home care programs. We have noticed slight evidence of excessive physicians' calls. We do believe that physician cooperation could reduce drug costs to a small extent.

Many local welfare commissioners believe that welfare costs for the chronically ill are excessive, and they are alarmed at the continuous rise in these costs. Nevertheless, the majority recognize that the problems of welfare care are increasingly related to the problems of chronic illness and aging and that medical costs may be expected to increase both because of the greater number of such persons receiving welfare assistance and because of the continuously increasing costs of care.

Our survey of nursing and convalescent homes in upstate New York, undertaken in co-operation with the Commission on Chronic Ill-

ness, indicated that the majority of the homes provided adequate medical and nursing service. Few of the homes, however, provided medical or social rehabilitation, recreational services, or planning for any disposition other than continued stay at the home. Yet, a high percentage of the patients were out of bed except to eat or to rest, were able to walk alone or with the assistance of a cane or a crutch, were mentally clear, and were completely continent. It appeared that there should be immediate steps taken to provide more dynamic social and recreational programs for the long-term and mentally clear patients, and that there should be more intensive social and rehabilitation planning by physicians and social workers concerned with the individual patients. These additional services would naturally increase the costs for care in nursing homes.

The New York State Department of Health and the State Department of Social Welfare have developed a joint demonstration program for the rehabilitation of disabled public assistance recipients at the State rehabilitation hospital at West Haverstraw. The objective is to demonstrate what can be done for these patients and, if the results are favorable, to encourage local welfare departments to provide the full cost of such service.

## A Call for Action



The summarizing committee agreed that we would like to consider the National Health Forum from the viewpoint, at least in part, of a member of the "consuming" public—one who must approve or support the types of action that have been discussed in the past 2 days.

*By Morton L. Levin, M.D., assistant commissioner for medical services, New York State Department of Health, and chairman of the summarizing committee of the National Health Forum.*

We were impressed by the fact that this has been truly a national forum on health. We have received greetings from the President, from 31 State governors, in person from Mayor Robert F. Wagner, and from Mrs. Franklin D. Roosevelt. We have been given the assignment of trying to set up guidelines for the Nation for needed action on chronic illness. In considering what action is needed, we have heard from 17 national, 7 State, and 19 local organizations, from State health commissioners, representatives of hospitals, a school of public health, and various types of voluntary and governmental agencies in local communities.

#### **The Type of Action**

What really was the subject of the forum? What have we been talking about? The summarizing committee agreed that these questions needed some clarification.

We have heard chronic illness described as "a daily disaster which is an acute emergency," and as "a major health problem which accounts for more than 70 percent of sickness." At the same time, we have heard chronic illness characterized as something in which hospitals, physicians, and the public generally are not greatly interested and for which it is hard to get money.

There seems to be some inconsistency in these two references to the term chronic illness. It hardly seems possible that there is a widespread lack of interest in the major causes of illness and disability. Perhaps what many people think of as chronic illness is not what we have been talking about, or only part of what we have been talking about. Apparently, to many people chronic illness means only the terminal, hopeless stages of illness, whereas it has been well established that chronic disease, in the sense in which the forum has used the term, need not necessarily bar a person from seeking the highest responsibility in our land.

Both by implication and by definite statement, the panel discussions have revealed that we have been discussing the effects of a large group of diseases which are well known by their individual names, such as cancer, heart disease, arthritis, cerebral palsy, vascular dis-

ease. Though many people are familiar with these diseases, apparently they do not know them under the general name of "chronic illness."

Most of the forum discussion was focused on certain types of action, which are needed for many chronic diseases at the same time—action that is not usually planned for a single chronic disease because it is needed for many chronic diseases at some stage of their course. One might call this type of action the common denominator aspect of chronic illness, and apparently this was the subject of the forum.

The summarizing committee was impressed with the repeated evidence that few people understand or are concerned about these common denominator types of activities. One possible conclusion to be reached from the deliberations of the forum is that the first action needed is to explain to the people—and especially to those who, by reason of money, power, and prestige, control community action—exactly what is meant by chronic illness in the terms of reference to the forum. Perhaps the forum has demonstrated that more of this type of explanation is needed before the desirable action is likely to take place.

The forum discussed parts of the common denominator aspects of chronic illness under various headings. Two panels discussed how to provide better care for the chronically ill at home or in institutions. Another panel was devoted to a specific kind of care, that called rehabilitation. Two panels were devoted to action by certain agencies—one by State health departments and one on what various types of city or county agencies were doing in this field.

#### **Some of the Conclusions**

The committee agreed that the most significant contribution made by the various panels was in describing examples of successful community action. We have heard many accounts of what may truly be called "success stories"—in developing home care programs; in linking hospital care with nursing homes, old-age homes, rehabilitation facilities, and home care;

and in bringing rehabilitation to people in nursing homes.

The examples we heard indicate that some communities have developed the know-how needed to lessen the disabling consequences of chronic illness, to give sick people the best chance to get back on their feet (that, apparently, is what is meant by "rehabilitation"), or to live their remaining years with as much activity, comfort, and decency as are reasonably possible. But, for some reason, the knowledge gained from these successes is not being used in most places. As to "why not?" the forum did not provide any specific answer.

We do not know why these common denominator types of action, which are obviously desirable, important, and useful, are failing to take place in more areas; we also do not know to what extent they are not taking place. The descriptions of the studies made by the Commission on Chronic Illness in Baltimore, Md., and Hunterdon County, N.J., the rehabilitation study going on in Kansas City, Mo., and in nursing homes in Peoria, Ill., suggest that the gap between demand and supply may be greater than has been suspected. These studies should tell us what are—to use one of the clichés in the field—the unmet needs.

Implicit in this conclusion is the need for an inventory of the extent of illness and disability in the Nation. The findings of the forum support the desirability of conducting a national survey of morbidity as a first step toward determining the most important gaps in providing care for people with all types of illness and especially for people with chronic diseases and disabilities.

A second implication is that a part of the money now being spent by various groups for specific diseases could well be earmarked for support of the common denominator services which are of importance to many chronic diseases. The forum also brought out the suggestion that some of these funds should be expended on an appraisal of how effectively the

rest of the money is being utilized for the various special programs.

Largely missing from the various discussions was a description of "the source of motion" for the action described. We were told about what happened but not why. We did not learn how it happened that a particular person or agency took the initiative for action. Exploration of these hidden springs of community action should prove helpful to those interested in promoting action in their own communities.

The discussions, however, did reveal some suggestions concerning the type of person or agency who might take the initiative. A president of a county or city medical society, a health officer, a council of social agencies, a visiting nurse association, a welfare department, and a general hospital were cited as specific examples.

The forum agreed that, when health leaders decide to initiate action, they should, first of all, bring people together to decide what is most needed in their community, and then develop a plan for specific action that people will understand and can start with; in other words, they should not necessarily try to do everything that needs doing at the same time.

As to priorities among programs recommended, there were outstanding examples: for instance, by almost unanimous choice, a home care program. Other activities which have high community acceptance are a referral and counseling service and rehabilitation programs for special groups of disabled persons, such as those in nursing homes.

Finally, the forum brought out the point that, if the need is shown for more effective services for the chronically ill, a good community leader usually can find the necessary money to provide at least part of these services. Apparently, the leader for developing these services should be an "actioneer"—a word coined by the forum—meaning one who combines the ability of an auctioneer in selling programs and the ability of a buccaneer in overcoming obstacles and opposition.

# SERVICE with DISTINCTION

*a story of the*  
Public Health Service

Filmstrip: 35 mm. black and white, 12½ minutes,  
with music and narration on record. 1955.

Filmograph: 16 mm. black and white, 10 minutes,  
with sound track. 1955. Identical with filmstrip  
but for use in a motion picture projector. "Dis-  
solves" and fast pacing give illusion of motion.

Audience: Professionals in the fields of clinical medi-  
cine, medical and biological research, and pre-  
ventive health services.

Available: On loan from: Chief, Recruitment Branch,  
Division of Personnel, Public Health Service,  
Washington 25, D. C.

**S**ERVICE WITH DISTINCTION is a pictorial story of Public Health Service activities throughout the world. Physicians, nurses, sanitary engineers, dentists, veterinarians, and other categories of professional personnel are shown carrying out representative activities in the Service's many continental stations and its overseas programs. Although useful in orienting audiences to the work of the Service, the filmstrip and filmograph stress opportunities for careers for commissioned officers in the Public Health Service. Opportunities for temporary duty in national emergencies as a member of the Service's Commissioned Reserve are also described. Using the technique of "quick cuts," "Service With Distinction" takes the spectator on a tour of the Service's installations in this country, harks back to its origin in 1798, and then describes professional opportunities in the fields of clinical medicine, research, and preventive health services. Scenes shown are those of PHS officers carrying out their assigned duties.



National Institutes of Health, Bethesda, Md.



United States Quarantine Station, Miami, Fla.

**The Story of the Service  
Is a Story of People**

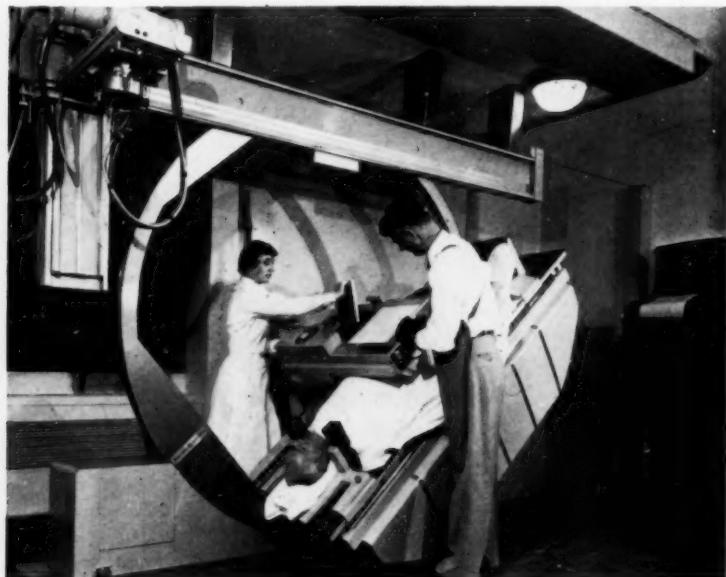
"Service with Distinction" stresses the role of Public Health Service professional personnel, rather than installations and institutions. The story, as it unfolds, is about people, such as Lumsden, Stiles, Rosenau, Francis, Armstrong, and Mahoney, who have made the Service a vital health force through the world. The film moves on to describe the work of the Public Health Service commissioned officers in the United States and on health missions in other parts of the world.



. . . they have served with distinction since 1798



Lumsden and others have left their mark



. . . more than 250 occupational specialties



. . . a long-established career organization



. . . medical care . . .



... medical and biological research ...



... preventive health services



... a medical officer in Liberia



In national disaster, the Commissioned Reserve



For commissioned officers, a variety of professional experience

For careers in clinical medicine, preventive health services, and research --- join the Regular Corps.  
For temporary duty and for service in national emergencies --- join the Commissioned Reserve.

# Variations on the Theme Mental Health in Nursing

By RUTH E. SIMONSON, R.N.

ON a Sunday morning in March 1955, I opened the *New York Times* to the article, "Nebraska Fights Mental Illness."

As I read the description of the many innovations to enhance the treatment potential of mental patients, and the discussion of the part the institute could take in solving the problem of mental illness, my thoughts turned to what the Nebraska Psychiatric Institute could mean to nursing.

I visualized the new institute as providing an opportunity not only to advance our knowledge about psychiatric nursing but also to apply the knowledge to general nursing.

At this, the dedication of the institute as a research center in the care of the mentally ill, it is appropriate to consider some of the opportunities for psychiatric nursing which are

specific to this setting. Psychiatric nursing is being redefined, and the imperative need for both independent study and collaborative research is recognized.

For example, the statement of Dr. Arthur P. Noyes (1), that the nurse should be a psychotherapist in her limited but definite field, indicates that the breadth as well as the limits of psychiatric nursing must be made increasingly clear. The nursing profession itself must assume the responsibility for identifying its area of function and for describing and justifying what is done.

Psychiatric nursing needs exploration and study as to how it can enrich the profession of nursing. I do not question that psychiatric nursing leadership will do the exploring and at the same time safeguard its responsibility. My concern is with the enrichment of general nursing.

Will the schools of nursing, the nursing services, and community nursing programs, in their day-to-day work with the ill, take advantage of the opportunity to study psychiatric content?

Will general nursing work collaboratively with psychiatric nursing in applying psychiatric content to the care of the general patient?

## Nursing and Mental Health

At its annual conference with State mental health authorities in December 1954, the Asso-

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Miss Simonson is mental health nurse consultant for Public Health Service Region II, New York City. Her speech on mental health in nursing, in its original form, was part of the observance of Mental Health Week, May 1-7, 1955, when the Nebraska Psychiatric Institute, Omaha, was dedicated. Miss Simonson is a member of the council of the newly established mental health section of the American Public Health Association and vice chairman of the Interdivisional Council on Mental Health and Psychiatric Nursing of the National League for Nursing.

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ciation of State and Territorial Health Officers gave formal recognition to the importance of mental health in nursing. At that meeting the association recommended that the principles of psychology be incorporated into all nursing and, particularly, into the community aspects of nursing (2). The health officers also recommended that each State mental health authority employ one or more mental health nurses to help carry out this recommendation.

The nursing profession shares the abundant interest in mental health evident in other professional groups. By its very nature, nursing is a personal and individual service which fosters close relationships. The nurse herself inevitably affects the mental health of the patients and families with whom she works.

The setting in which nursing is practiced offers its own unique opportunity for the promotion of mental health. The setting may be a hospital, a home, a clinic, a school, or a factory. The responsibility may be to the sick, to the convalescent, to the healthy. Yes, the nurse has opportunities in every phase of the mental health program. She shares in the prevention of mental illness, in the treatment of the mentally disturbed, in the rehabilitation of the mental patient.

Mental health in nursing lends itself to many variations. We accept that nursing has the potential for working constructively in mental health. Let us think of ways to nurture this potential.

#### **The Use of Self**

In nursing, we have tended to look at ourselves as outside the patient's problem. But little by little we have begun to tear down the wall that we built around ourselves. We are beginning consciously to take into account what the nurse, in her use of self, brings to a situation that changes it. The fact that there has been a shift in nursing research from functional studies in nursing service to a concern with nursing care which emphasizes nurse-patient interaction is proof of this change.

The report on "Favoritism in Personnel" in the February 1955 issue of *Nursing Research*, published the not-surprising conclusion that nurses like certain patients better than others

and that this factor makes a difference in the nursing care she gives. Her approach to the preferred patient is warm and friendly. He is respected as a person. The approach to the nonpreferred patient is more routine and business-like. He is treated as a patient (3). Recognition of this hitherto vaguely sensed bias is but the first step in its correction. The next step must be the development of appropriate methods to help the nurse meet the basic need of every patient to be treated as a person whether he is preferred or nonpreferred.

We have been content too long to emphasize the importance of recognizing the emotional components of nursing care. We have paid too little attention to the development of the skill that helps us apply the knowledge we have accumulated. Unfortunately, knowledge cannot be transferred directly and automatically to appropriate situations, for learning does not develop in that way. It is fostered in a climate where new approaches to traditional tasks can be tried out and modified.

Dr. George E. Gardner, writing in *Mental Hygiene* about higher education and mental health, makes the point that the development of emotional maturity is the first mental health task of the student. In that sometimes elusive search, he says, it is of primary importance to establish a realistic concept of one's self—one's ability and one's potentiality—and to establish a realistic appraisal of the responses to be expected from others (4).

Self-awareness, insight, and the realistic appraisal of responses come to the nurse as she works directly with her patients. That step in the learning process is hastened with competent guidance.

In a study completed in 1954 for the Public Health Service, Frances Kreuter and Marguerite Kakosh have developed criteria for qualitative appraisal of nursing care. I have been in fairly close touch with the part of their study concerned with communication as nursing skill. The graduate nurse students who participated were studying at the university and having field experience in a generalized hospital as part of it. They kept detailed diaries of daily patient care experiences. This included verbatim accounts of some of the conversations with patients for

whom they cared. With conscious attention they studied what the patient said and their own replies.

From subsequent discussions of the recorded conversations, it became apparent that nurses need to learn the skill of listening and to listen as nurses. Although the discussions showed intellectual acceptance of the value of encouraging expression of feeling, the students found it difficult as nurses to permit, let alone encourage, expressions of hostility or of any negative feeling when they were face to face with a patient. In fact, they shied away from any feeling which evoked uncomfortable feelings within themselves. This was not lack of concern for the patient but rather inability to allow any discussion that would interfere with the harmonious atmosphere nurses have been taught to consider essential.

One nurse, in reporting her experience with a patient, saw the problem in nursing care as one of uncooperativeness in following the physician's orders. Her real difficulty was in her effort to understand the basis for what seemed like deliberate perverse behavior. It was even more difficult for her to analyze her own feelings.

When she was asked, "Do you feel drawn to this patient?" she said "No," and, "Were you with him in your feeling?" she also replied "No." Then, when asked "Did you feel that you were against him in your feeling?" she replied, "Yes, but this is the first time I have ever looked at it this way. This is hard to face."

The process of looking objectively at one's self in a situation and gaining some understanding is indeed slow and sometimes painful. To do so requires supportive help. Perhaps this process can be illustrated best by two real situations.

### Case Illustrations

Mr. Brown was referred to a public health nursing service after his dismissal from a rather prolonged hospitalization for a heart attack. His physician requested that he be encouraged and supported in increasing activity. Mr. Brown's condition and potentialities were reviewed with the nurse. She was familiar with the philosophy that the management of a car-

diac patient is directed toward improved physiology and that therapy combines judicious use of rest, activity, and modification of diet and daily living.

The nurse found Mr. Brown's family in a flurry of excitement at having him home again. His wife and his teen-age daughter, Marjory, hovered about trying to anticipate his every need.

He protested mildly, saying, "I've been doing a lot of things for myself at the hospital, Marjory. You make me feel like an invalid."

At this point, the nurse cautioned against "too much activity" and gave approval to Marjory's doing for her father the things he had been doing for himself. Throughout that first visit, as she carried out the appropriate techniques of nursing care, she admonished Mr. Brown to be careful. As she left, he remarked, "I thought coming home was a good idea, but I'm afraid that I came home too soon."

She was uneasy about the visit. She was aware of her reluctance to encourage increased activity for Mr. Brown although she accepted, intellectually, that it was important for his recovery. Through discussion she became more aware of what had happened during her visit. She realized that she had not supported Mr. Brown's movement toward health but had actually reactivated his feeling of helplessness and dependency. She recognized that she had reinforced the anxiety of the mother and daughter. She said, "I tried to reassure them, but they seemed more worried when I left."

On being encouraged to explore her own feelings about heart disease and talk about them, she recalled an experience as a student nurse.

She told of a cardiac patient on complete bed rest who openly defied the doctor's instructions and the nurse's admonitions by occasionally getting out of bed. One day he walked out into the hall to make a telephone call and died in the booth. "It was almost as if Mr. Morris were prompting me over my shoulder to keep Mr. Brown quiet."

This is an illustration of what I mean by saying that self-awareness and insight come as the nurse works directly with patients when she is helped to recognize how her own feelings influence the care she gives the patient.

Let's take another illustration. Bob, a 15-year-old, had been in the hospital with rheumatic fever for 2 weeks and on complete bed care for that time. He often looked unhappy, and the nurses tried to cheer him up by telling him how lucky he was that his heart condition had been discovered early and that he was under such good care. He was instructed in the necessity of "being careful when he went home" and "not to overdo."

On being dismissed from the hospital, Bob was referred to a public health nursing service. The doctor wanted him to have bed rest for a time, then graduated activity. The nurse's responsibility was to demonstrate and give nursing care and to help the mother carry out the doctor's orders. After several visits, the nurse came to the supervisor with this story:

"That kid just won't pay any attention to what he's told. He gets out of bed. He doesn't want me to give him his bath. He won't pay any attention to his mother; she's getting all worn out. The doctor told the father that he would be a cardiac cripple if the situation continued. His father is irritable with the mother and impatient with the boy. The boy won't pay any attention to his father either. And the young sister—she was such a nice kid—is turning into a regular pest. The whole household is at sixes and sevens."

This was a situation in which increased understanding of the adolescent was essential, first for the nurse, and then for the family: the need of the adolescent, for example, to be self-directing and to have some part in the planning that affects him, to be considered an individual in his own right. The need of the other members of the family and the implications of the illness were reviewed. The nurse was given help in ways in which she might involve Bob and his family in plans for his care. She was supported in her work with the family, and encouraged to express and analyze her own feelings about the way Bob behaved. Open discussion gave her a better appreciation of the emotional factors in the situation.

This example is given to show how certain mental health concepts become real as the nurse is helped to make practical application in her work with families. The unhappy and re-

bellious boy who was making his illness worse became very much interested in the therapeutic regimen as he was brought into the planning and in himself had a measure of control. The nurse felt that for the first time she had seen the implication of an illness for a family in relation to herself, with its possible implications for herself. She, too, had learned a measure of control by the conscious use of self.

#### In Touch With Others

With respect to freeing the potential of the nurse, it is important to emphasize the responsibility of administration for providing a setting in which quality nursing can be practiced.

Administration articulates and communicates the values in any institution or system. They may not be clearly articulated, but they will be communicated. If respect and concern for the patient is all important, that attitude will be communicated, and service, research, and training of personnel will reflect it. If, however, the development of specialized treatment is the only goal, and the patient is merely an accessory for research, that attitude, too, will be communicated. In that event, the system virtually prohibits nursing dedicated to the comprehensive care of the patient.

In addition to providing the environment for nursing care, administration has the responsibility of seeing that nursing is fully utilized in the service, research, and training activities of the institution. Though we are accustomed to think of research advances in other disciplines which may contribute to the preparation of nurses, how often do we think in terms of what nursing can contribute to other professions? The new climate in some of our teaching and research centers is making it possible to identify and describe some of the ways in which nursing can contribute to other disciplines so that they can be consciously used.

Dr. John Rose of the Philadelphia Child Guidance Center has written in an unpublished report:

"The nurse-family-child interaction is of primary importance in its own right. It is our experience, however, that the nurse is the only person who can fill certain gaps in the resident's experience." Dr. Rose was referring to his

own experience in the preparation of pediatric residents.

It is not enough to recognize that mental health is an integral part of all nursing or that the nurse should deal effectively with the emotional aspects that are a part of every situation she meets. Recognition, when we lack the knowledge and skill to function effectively, is immobilizing. The nurse must be helped in the use of self. That is her great potential.

Anne Morrow Lindbergh says it so simply for us in *Gift from the Sea* (5): "When one is a stranger to one's self, then one is estranged from others, too. If one is out of touch with one's self, then one cannot touch others."

It is our privilege to be in touch.

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### New Members of the PHR Board of Editors



Miss Arnstein



Mr. MacKenzie



Dr. Simmons

The 3 most recent appointees to the 13-member Board of Editors of *Public Health Reports* are introduced below. The new members, whose 3-year terms end in 1958, replace Dr. Justin M. Andrews, Dr. Ruth Freeman, and M. Allen Pond.

**Margaret G. Arnstein, R.N., M.P.H.**, chief of the Division of Nursing Resources, Public Health Service, began her public health nursing career in Westchester County, N. Y. Subsequently, she served as consultant to the New York State Department of Health, first in the communicable disease field and later as district consultant for New York City. During the 3 years spent as director of the program for public health nurses at the University of Minnesota, she collaborated with Dr. Gaylord Anderson on the book "Communicable Disease Control." In charge of nursing for the UNRRA Balkan Mission, Miss Arnstein spent 15 months in the Middle East, where she organized nursing care in 2 Greek and 3 Yugoslav refugee camps and laid plans for work in the 3 Balkan countries under the mission.

**Vernon G. MacKenzie** is assistant chief for research and development, Division of Sanitary Engineering Services, Public Health Service.

After graduation from Massachusetts Institute of Technology in 1927, Mr. MacKenzie served 9 years in sanitary engineering research and design for the city governments of Chicago and Detroit. In the American Mission for Aid to Greece, he was deputy director of the Public Health Division. From 1948 to 1954 he was officer in charge of the Robert A. Taft Sanitary Engineering Center of the Public Health Service, Cincinnati.

**Leo W. Simmons, Ph.D.**, is professor of sociology at Yale University, with a joint appointment in the department of psychiatry. He is also doing research under the auspices of the Russell Sage Foundation. Dr. Simmons was awarded his doctorate at Yale in 1931 and returned to the university in 1936 as a research assistant in sociology. Following field studies of the Hopi Indians in 1938 and 1941, he edited "Sun Chief," an autobiography of a Hopi Indian, 1942, and wrote "The Role of the Aged in Primitive Society," 1945. His study of the social aspects of medical care in hospital settings at Cornell Medical Center 1950-52 is reported in "Social Science in Medicine," with Harold G. Wolff as co-author.



## Health Supervision of Infants and Preschool Children

THE Working Group on Service Programs of the Public Health Conference on Records and Statistics has evolved a series of suggestions pertaining to the collection, analysis, and interpretation of service statistics as tools in effective health supervision of infants and preschool children. It was necessary to limit attention to health supervision because of lack of time in which to consider such additional aspects of child health programs as pediatric clinics and care of premature infants.

The working group recognizes wide variations in program content and in stages of development and available facilities in health departments at all levels, and considers that changing concepts and new approaches are vital to the attainment of goals in public health work. Prescribing specific statistical patterns

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*This is the second in a series of statements developed by the Working Group on Service Programs, originally named the Working Group on Service Statistics, of the Public Health Conference on Records and Statistics. In arriving at the conclusions embodied herein, the working group had the benefit of consultation with Dr. Martha Clifford, director of the bureau of maternal and child hygiene, Connecticut State Department of Health. The first statement was an outline of basic principles governing service statistics in public health, which appeared in the June 1956 issue of Public Health Reports, p. 520.*

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which would be applicable to all health departments was considered neither desirable nor possible. Consequently, the proposals of the working group should be regarded as a framework within which each health department may develop a statistical program in accordance with its own desires.

### Prerequisites to accumulation of meaningful statistics

The following conditions must exist if meaningful service statistics are to be developed:

1. The objectives and scope of the program must be clearly defined.
2. Statisticians and program personnel such as physicians, nurses, nutritionists, social workers, and health educators should have a part in determining the kinds of information needed and in developing plans for its collection. The statistician should function as a member of the professional team in initial planning of the program as well as in program operation and evaluation.
3. The purposes to be served by statistical data should be clearly specified. Reports should be prepared only to fulfill specific purposes.
4. Provision should be made in advance, during the initial planning stage, for periodic evaluation of statistical procedures.
5. Statistics developed for health supervision of infants and preschool children should be correlated with statistics developed for related programs of the health department. One

means toward this end is to have a records committee periodically pass on and review basic statistical forms of the several programs.

#### Kinds of information necessary for effective operation of service

Information desirable for operation of effective health supervision of infants and preschool children is of three main types:

1. Baseline data should be used for determining overall needs and for evaluating completeness of service. According to the definition developed by the working group, these baseline data are not included as service statistics. It should be emphasized that service statistics are most valuable when related to baseline data. The working group considered it appropriate to cite a few examples of baseline data useful for the planning and evaluation of infant and preschool health services: live births, by geographic area; infant and preschool deaths, by cause; illnesses reported, by cause; births occurring at home; economic status of population, by geographic area; racial characteristics of population, by geographic area; availability of private and voluntary medical and allied personnel, facilities, and services; and resources of the health department.

2. The second type of information is that which would assist physicians, nurses, and other health department persons primarily in giving service to individual infants and preschool children. The kinds of information listed below outline valuable statistics for operating an effective health program:

- Total number of individual children served by the health department (unduplicated count) distributed by geographic area, new cases and old cases, and characteristics of children served (age, sex, color).

- Volume of service (number of visits).

- Type of service, for example, physical examination, dental services, immunization, parent counseling, referrals to other medical services, and results of referrals.

- Site of service, for example, child health conference, home visits, and immunization center.

In order to obtain this information, the following types of data should be routinely available regarding each child served by the health

department: date of birth, sex, and race of child; geographic area in which child resides; date of admission to service; number of times served by the health department, in the home and in child health conferences; kinds of services received from the health department.

Individual health departments should develop applications of the statistics outlined above in combination with each other to meet the needs of their own programs. Examples are number of children immunized, by age; types of service given to new as compared with old cases; and volume of service by site of service. Such data may be compiled either routinely or through special studies.

3. Then, there are the kinds of information that would assist program administrators primarily in analyzing the operation of their programs. Types of data regarding operation of the program, which should be available either routinely or through special studies are these:

- Total attendance, by age group and status (new or old patient) of children, at each clinic or conference, and personnel time involved. For example, reports of clinic attendance might suggest changes in clinic policy, dates, hours, or location in order to adjust services to needs. Also, effectiveness of home nursing visits might be evaluated. Total clinic visits related to physician time can be used to evaluate clinic policies.

- Incomplete services indicated by number of children previously under care but not given service over a certain length of time; percentage of children with broken appointments; number of cases with undue waiting time between appointments; number of children who have not been vaccinated or immunized; and failures to respond to recommendations. This information may be used for evaluation of general performance and policy.

- Summary of program activity, for evaluating personnel needs of a program, and for justifying specific types of expenditures.

- Clinics in operation in relation to economic status of geographic areas.

#### Techniques for collection, tabulation, analysis, and interpretation of information

*Source documents.* Information for service statistics may be obtained from conference or

clinic attendance records, basic family unit records, individual case records, tickler cards, nurses' daily activity reports, and the like.

*Methods of tabulation.* Service statistics may be tabulated by:

1. Manual methods—These methods of abstracting information by manual sorting and counting up individual case summary cards, or tally sheets, are applicable in small health departments.

2. Marginal-punched, hand-sort cards—This method permits ready analysis where the volume of service is not large enough to justify mechanical tabulation.

3. Mechanical tabulation—This method is practical in health departments with a large volume of services.

*Frequency of compilation.* The frequency with which specific reports should be compiled must be determined locally depending on uses to be made of the data. Unduplicated counts of individuals served should be tabulated annually on a calendar-year basis and more often if needed.

Compilation of all service statistics on a calendar-year basis is recommended for comparison with baseline data. Where these statistics are required for fiscal purposes, compilation on a fiscal-year basis should supplement, but not substitute for, calendar-year data. The working group cautions against more frequent tabulations than are justified by use.

*Special studies.* Special studies are useful tools in program evaluation. They are recommended as a device to reduce the number and complexity of routine reports wherever possible. Routine reports should concentrate on minimum essentials for reflecting program, avoiding over-refinement of data.

Some types of service statistics which might be obtained through special studies are determination of levels of immunizations, evaluation of specific new services or program techniques (for instance, triple antigen, administration of vitamins), changes in behavior resulting from health department activity, determining reasons for lapses in attendance at child health conferences or for failures to complete immunizations, comparison of effectiveness of individual interviews and group conferences, and time and cost studies.

*Methods of interpretation and presentation.* The mere tabulation of data does not in itself provide for maximum utilization of service statistics. There should be a team approach in planning summary tables, narrative analyses, graphic presentation, trend data, and how and when the collected data are to be used.

Statistical measurements of service should be interpreted in relation to baseline data, needs for services, and program objectives. Only thus can an approach be made to evaluating accomplishments of programs.

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*The statement has been reproduced in mimeographed form as attachment A to document 229 by the National Office of Vital Statistics, Public Health Service, Department of Health, Education, and Welfare, Washington 25, D. C.*

*Under the title, "A Guide for the Collection, Analysis, and Interpretation of Service Statistics in Health Supervision of Infants and Preschool Children," it has the endorsement of the following organizations: Association of State and Territorial Directors of Local Health Services; Council of State Directors of Public Health Nursing; and the Statistics Section, and Committee on Administrative Practice, American Public Health Association.*



*Comparative biochemical studies and counts of suspended algae and protozoa in a small Ohio stream give evidence that the effluent from a small sewage treatment plant characteristically causes an increase in certain green flagellates (Euglenophyceae) and the disappearance of the yellow brown flagellates (Chrysophyceae).*

## Stream Enrichment and Microbiota

By JAMES B. LACKY, Ph.D.

IT has been well demonstrated that one ultimate effect of sewage or of treated sewage effluents is the fertilization of the receiving stream or body of water (1-7). This generalization, however, is seldom based on actual counts of species and of their numbers in the receiving waters. It is usually based on a study of a few kinds of organisms or of a broad classification, such as green flagellates. In the few instances in which the actual numbers and kinds of species occurring below points of waste or sewage admission have been studied (1, 4, 8, 9), no companion studies have been undertaken on nearby and somewhat similar waters as controls.

To provide more specific information on the fertilizing effects of a treated sewage effluent, an ecologic study of the suspended microbiota in Lytle Creek, a small stream in southwestern Ohio which receives such an effluent, was begun in the summer of 1944. In this study, the qualitative and quantitative distributions of the suspended algae and protozoa at points selected

to reflect the effects of the effluent were determined. For comparison with Lytle Creek, similar studies were made of Cowan Creek, an unfertilized stream in the same area, and of the Santa Fe River, a larger unfertilized stream in Florida. The findings of these studies are presented in the following pages.

Lytle Creek has been the scene of three earlier reports. Gaufin and Tarzwell (10) have described the known invertebrates (exclusive of protozoa); Cooke (11) has considered the ecology of the fungi; and Katz and Gaufin (12) have discussed the fish. These papers, together with the present one, give an account of the majority of the living organisms in Lytle Creek and provide what is perhaps the most nearly complete story of one stream.

### The Ohio Streams

Lytle Creek is about 11 miles long. In the summer of 1944, when it was sampled for this study, it had a flow of about 1 cubic foot per second except after showers. The stream drained a small rural farming section and received the effluent from the sewage treatment plant for Wilmington, Ohio, a town of about 6,000 population (1940 census). The sewage effluent was the only pollution entering the stream. The stream showed a typical oxygen depletion just below the treatment plant outfall, with recovery before it entered Todd Fork about

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7 miles away. Typical dissolved oxygen ranges, pH values, and temperatures in Lytle Creek are given in the paper by Gaufin and Tarzwell (10) or the one by Cooke (11). Although the work reported in this paper antedates theirs, conditions were probably very similar.

Cowan Creek is located in an adjoining watershed and is similar in length and flow. However, its watershed, which is arable, pasture, or wooded land, is sparsely inhabited, and the stream receives no visible pollution. According to samples from one point, biochemical oxygen demand (BOD), the dissolved oxygen, and the nitrate content corresponded roughly to station V on Lytle Creek.

#### *Sampling Procedures*

Samples from Lytle Creek were taken at five stations, which had been set up for a study conducted by the Public Health Service. Their locations are shown in figure 1. Station I, at mile 8.7 above the mouth of the creek, was within the city limits of Wilmington. Station II, at mile 7.2, was a short distance below the outfall of the sewage treatment plant. Station III was at mile 5.2, where there was little visible evidence of the sewage effluent, and stations IV and V were at miles 3.2 and 1.0, respectively,

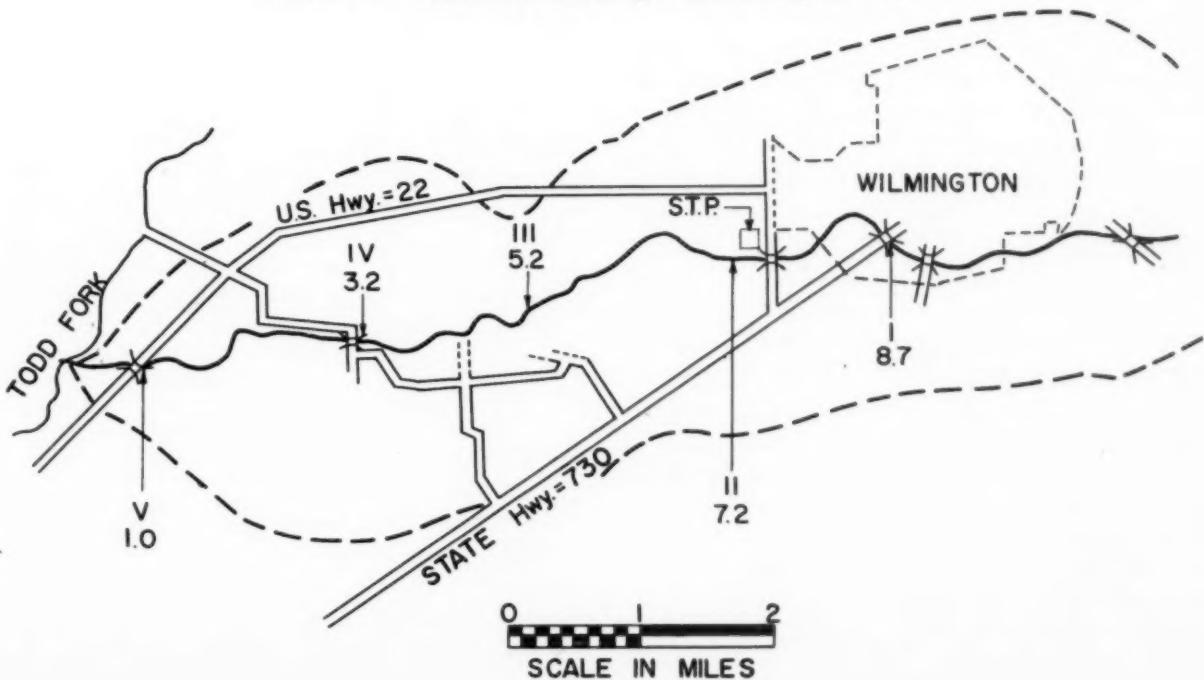
where the stream presented a practically normal appearance. Samples from Cowan Creek were taken at only one point, which corresponded in mileage from the mouth to Lytle Creek V.

These two streams were sampled approximately every 2 weeks beginning June 19 and ending August 15. The samples, totaling 33, were brought to the stream pollution investigation station at the Environmental Health Center (now the Robert A. Taft Sanitary Engineering Center), Public Health Service, and there analyzed for kinds and numbers of organisms and certain biochemical data. The sampling period covered the time of low flow and high temperature, when populations of algae and protozoa are normally at their highest. Practically every organism found had been recorded previously from other Ohio River Basin streams.

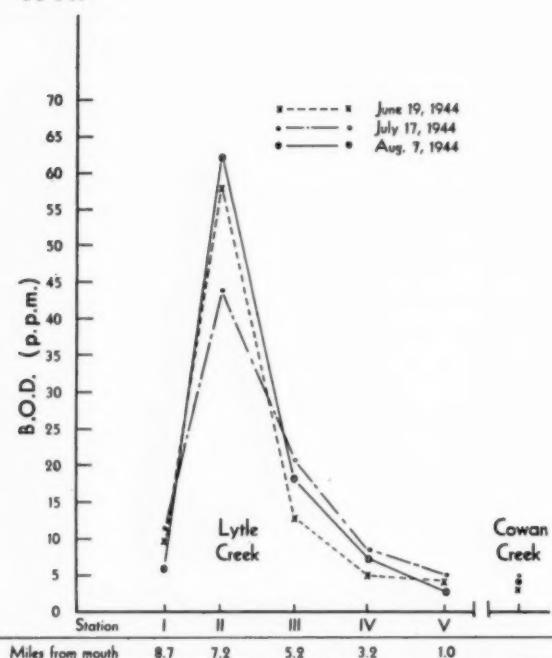
#### *Results*

The BOD values for Lytle and Cowan Creeks are shown in figure 2. The BOD figure of about 4 p.p.m. for Cowan Creek is close to the average for unpolluted creeks of this area that have been sampled. It is not surprising that the BOD value was so high at station II on Lytle Creek, since the dilution of the treatment plant effluent was not large. Perhaps the most sur-

**Figure 1. Location of sampling stations in Lytle Creek.**



**Figure 2. Range in biochemical oxygen demand (BOD) in Lytle and Cowan Creeks, summer of 1944.**



prising thing about the BOD values is the rapid decrease at the downstream stations.

The BOD values accord well with the values for nitrates and nitrites, shown in table 1. All three values, decreasing rapidly downstream, argue for large numbers of organisms, both saprophytic and holophytic (or saprozoic and holozoic), moving downstream.

A total of 167 species or genera of algae and protozoa were found in the 27 samples from Lytle Creek. In the 6 samples from the single Cowan Creek station, 92 species or genera were found. Table 2 lists all the species and gives the number of occurrences of each, by station.

Station I on Lytle Creek, the clean water station, had a total of 101 species, which occurred 195 times in the samples analyzed. These should have provided an excellent seeding for the downstream stations, if they were able to pass through the short zone of oxygen depletion, or possibly toxic zone, just below the treatment plant outfall. Forty-three of these species were found at station II. All of the Chrysophyceae and most of the Cryptophyceae, the Volvocales, and the diatoms (Bacillarieae) were killed in the zone of pollution, but the remaining groups, which recovered only slightly

in species, recovered surprisingly in numbers of organisms.

The number of species found at station I in Lytle Creek was never again equaled. The only group showing a downstream increase in species was the green Euglenophyceae. Station V, the lowest on Lytle Creek, showed 20 fewer species than the comparable Cowan Creek station, which had 9 fewer species than the uppermost Lytle Creek station. Eleven of the twelve species of Chrysophyceae found in Cowan Creek were found not at all in Lytle Creek after station I: Evidently this group will not stand recent sewage pollution. Even some of the blue-green algae disappeared. Other groups adversely affected at stations II, III, and IV were the Cryptophyceae, the Dinoflagellata, the Volvocales, the Chlorophyceae (which die rather slowly in polluted water), and the diatoms.

However, the downstream decrease in number of species was compensated for by the increase in number of organisms. If 500 organisms of one species per milliliter is accepted as a bloom value (13), there were from 2 to 6 blooms at the downstream stations as compared with one bloom at station I and no blooms at the Cowan Creek station:

	Blooms in Lytle Creek				
	I	II	III	IV	V
<i>Chromatium</i> sp	---	---	---	---	648
<i>Cryptomonas erosula</i>	888	-----	-----	-----	{ 512 1,100 15,040
<i>Navicula</i> spp	-----	{ 800 1,120	{ 660 680 568 800	2,640	512
<i>Trachelomonas urceolata</i>	-----	-----	-----	-----	640
<i>Euglena</i> sp.	-----	{ 784 504	-----	-----	5,760

**Table 1. Nitrate and nitrite nitrogen at six sampling points in Lytle and Cowan Creeks, July 24, 1944**

Station	Nitrate nitrogen (p.p.m.)	Nitrite nitrogen (p.p.m.)
Lytle Creek:		
I	0.10	0.01
II	.44	.02
III	.80	.08
IV	.08	trace
V	.08	trace
Cowan Creek	.04	trace

**Table 2. Micro-organisms found in Lytle and Cowan Creeks in the summer of 1944: number of occurrences of each species at each station sampled**

Genus and species	Lytle Creek					Cowan Creek	Genus and species	Lytle Creek					Cowan Creek								
	I	II	III	IV	V			I	II	III	IV	V									
<b>SCHIZOMYCETES</b>																					
<i>Beggiatoa alba</i>	1	-	-	4	-	-	<i>Collocladion triciliatum</i>	2	4	3	-	2	1								
<i>Blastocaulis</i> sp.	-	-	1	3	1	-	<i>Polytoma uvelia</i>	1	-	4	-	-	-								
<i>Chromatium</i> sp.	-	1	-	1	-	-	<b>BACILLARIEAE</b>														
<i>Sphaerotilus natans</i>	1	-	1	-	-	-	<i>Achnanthes coarctata</i>	4	-	1	-	-	-								
<i>Spirillum</i> spp.	1	-	-	1	2	-	<i>Coccineis placentula</i>	3	3	1	1	1	-								
<i>Spirochaeta</i> sp.	1	-	1	-	-	-	<i>Cyclotella meneghiniana</i>	6	5	2	1	1	3								
<b>MYXOPHYCEAE</b>																					
<i>Aphanocapsa</i> sp.	1	-	-	-	-	-	<i>Cymbella</i> sp.	3	-	-	-	1	2								
<i>Chroococcus turgidus</i>	2	-	-	-	-	-	<i>Diploneis</i> sp.	-	-	1	-	-	-								
<i>Lynbya</i> sp.	1	-	1	2	1	-	<i>Eunotia</i> sp.	2	1	-	-	-	2								
<i>Merismopedia elegans</i>	2	2	-	-	-	1	<i>Fragilaria cotonensis</i>	-	-	-	-	-	1								
<i>Merismopedia glauca</i>	2	-	-	-	-	1	<i>Fragilaria</i> sp.	1	-	1	-	-	1								
<i>Oscillatoria</i> spp.	3	3	5	4	3	1	<i>Gomphonema olivaceum</i>	1	2	-	-	-	1								
<i>Phormidium</i> sp.	2	-	-	-	-	1	<i>Gyrosigma</i> sp.	1	1	-	-	-	5								
<b>CRYPTOPHYCEAE</b>																					
<i>Chilomonas paramecium</i>	1	-	-	-	1	-	<i>Melosira granulata</i>	1	-	-	-	-	-								
<i>Chroomonas</i> spp.	3	1	2	-	2	4	<i>Melosira varians</i>	-	-	-	-	-	1								
<i>Cryptomonas ovalis</i>	-	-	-	-	1	1	<i>Neivicula</i> spp.	6	6	5	3	5	6								
<i>Cryptomonas</i> spp. (including <i>erosa</i> )	6	5	3	1	5	6	<i>Nitzschia closterium</i>	1	-	2	1	-	2								
<i>Cyathomonas truncata</i>	2	-	-	-	-	1	<i>Nitzschia sigmaeidea</i>	1	-	1	-	-	1								
<i>Rhodomonas lacustris</i>	2	-	2	-	-	3	<i>Pinnularia</i> sp.	1	-	2	1	2	-								
<b>CHRYSPHYCEAE</b>																					
<i>Chromulina globosa</i>	1	-	-	-	-	3	<i>Rhizosolenia eriensis</i>	-	-	-	-	-	1								
<i>Chromulina ovalis</i>	2	-	-	-	-	3	<i>Rhoicosphenia</i> sp.	1	-	-	-	-	-								
<i>Chromulina paschieri</i>	-	-	-	-	-	1	<i>Surirella</i> sp.	1	-	1	-	-	2								
<i>Chrysopsis sagene</i>	-	-	-	-	-	2	<i>Synedra acus</i>	-	-	-	-	-	2								
<i>Chrysococcus asper</i>	-	-	-	-	-	2	<i>Synedra biceps</i>	1	-	-	-	-	1								
<i>Chrysococcus ovalis</i>	-	-	-	-	-	2	<i>Synedra ulna</i>	1	1	2	-	2	3								
<i>Chrysococcus rufescens</i>	-	-	-	-	-	2	<i>Synedra</i> sp.	2	1	2	2	-	3								
<i>Chrysococcus spirale</i>	-	-	-	-	-	2	<b>EUGLENOPHYCEAE (green)</b>														
<i>Dinobryon sertularia</i>	-	-	-	-	-	3	<i>Cryptoglena pigra</i>	1	1	1	1	1	-								
<i>Mallomonas tonsurata</i>	-	-	-	-	-	1	<i>Euglena acus</i>	3	6	4	1	3	3								
<i>Mallomonas</i> sp.	-	-	-	-	-	1	<i>Euglena agilis</i>	1	1	1	1	1	-								
<i>Rhizochrysis scherffeli</i>	-	-	-	-	-	1	<i>Euglena anabaena</i>	1	1	1	1	-	-								
<b>DINOFLAGELLATA</b>																					
<i>Gymnodinium gracilis</i>	1	-	-	-	-	2	<i>Euglena deses</i>	3	5	3	1	-	1								
<i>Gymnodinium</i> sp.	-	-	-	-	-	1	<i>Euglena ehrenbergii</i>	3	-	-	1	-	-								
<i>Peridinium tabulatum</i>	-	-	-	-	-	1	<i>Euglena fusca</i>	1	1	-	1	-	-								
<b>VOLVOCALES</b>																					
<i>Brachiomonas</i> sp.	-	-	-	1	-	-	<i>Euglena gracilis</i>	1	1	1	2	-	-								
<i>Carteria elongata</i>	1	-	-	-	-	-	<i>Euglena granulata</i>	1	3	1	2	-	-								
<i>Cephalomonas granulata</i>	3	-	-	-	-	1	<i>Euglena oxyuris</i>	1	4	3	-	2	-								
<i>Chlamydomonas</i> spp.	6	6	5	5	4	5	<i>Euglena pisciformis</i>	2	4	4	3	4	1								
<i>Chlorogonium minimum</i>	-	-	-	-	-	1	<i>Euglena polymorpha</i>	2	5	3	3	3	-								
<i>Gonium pectorale</i>	-	-	-	-	-	1	<i>Euglena quartana</i>	-	-	4	-	-	-								
<i>Heteromastix angulosa</i>	2	2	1	1	1	1	<i>Euglena sanguinea</i>	1	1	-	-	-	-								
<i>Lobomonas rostrata</i>	-	-	-	-	-	1	<i>Euglena sciotensis</i>	1	2	1	1	1	2								
<i>Pandorina morum</i>	-	-	-	-	-	1	<i>Euglena spirogyra</i>	-	1	-	1	-	1								
<i>Pedinomonas rotunda</i>	1	-	-	-	-	1	<i>Euglena tripteris</i>	1	-	-	-	-	-								
<i>Phacus angulosus</i>	-	-	1	-	-	4	<i>Euglena viridis</i>	4	6	2	4	3	1								
<i>Phacus lenticularis</i>	4	-	-	1	1	1	<i>Euglena</i> sp.	4	6	5	4	5	2								
<i>Pyramidomonas inconstans</i>	2	-	-	1	1	3	<i>Lepocinclis marssonii</i>	1	4	2	1	1	2								
<i>Scherffelia phacus</i>	-	-	-	-	1	-	<i>Lepocinclis ovum</i>	2	5	3	1	3	3								
<i>Spermatozopsis exultans</i>	-	-	-	-	-	1	<i>Lepocinclis steinii</i>	1	-	-	-	-	-								
<i>Spondylomonas quaternarium</i>	-	-	-	-	-	1	<i>Lepocinclis texta</i>	3	2	-	-	-	-								
<i>Thoracomonas</i> sp.	1	-	4	-	-	2	<i>Phacus anacoleus</i>	2	2	1	1	-	-								
					2	1	<i>Phacus brevicauda</i>	3	1	-	-	-	-								
						1	<i>Phacus longicauda</i>	-	-	-	1	-	-								
						1	<i>Phacus pleuronectes</i>	2	3	3	-	1	-								
						1	<i>Phacus pyrum</i>	3	3	2	1	-	-								
						1	<i>Phacus stokesi</i>	3	2	-	-	-	-								
						1	<i>Phacus suecica</i>	1	-	-	-	1	-								
						1	<i>Phacus triquetus</i>	2	2	1	-	-	-								
						1	<i>Phacus</i> sp.	-	1	-	-	-	-								
						1	<i>Trachelomonas crebea</i>	-	-	-	2	-	-								
						1	<i>Trachelomonas hispida</i>	1	-	-	1	-	-								

**Table 2. Micro-organisms found in Lytle and Cowan Creeks in the summer of 1944: number of occurrences of each species at each station sampled—Continued**

Genus and species	Lytle Creek					Cowan Creek	Genus and species	Lytle Creek					Cowan Creek
	I	II	III	IV	V			I	II	III	IV	V	
<b>EUGLENOPHYCEAE—Con.</b> (green)													
<i>Trachelomonas stokesi</i>			1	1	2								3
<i>Trachelomonas teres</i>	1												1
<i>Trachelomonas urceolata</i>	1	5	1	1	5								2
<i>Trachelomonas volvocina</i>	2	1	1	1	3								3
<b>EUGLENOPHYCEAE</b> (colorless)													
<i>Anisonema ovale</i>	1					1							
<i>Astasia klebsii</i>		1		3	1								
<i>Copromonas subtilis</i>				1									
<i>Distigma proteus</i>	1												
<i>Entosiphon sulcatum</i>	2												
<i>Menodium incurvum</i>	1	1	1	2									
<i>Metanema</i> sp.	1												
<i>Notosolenus apocampatus</i>			1										
<i>Peranema trichophorum</i>	1	1	1										1
<i>Petalomonas angusta</i>						1							
<i>Petalomonas carinata</i>						1							
<i>Sphenomonas quadrangularis</i>		3	4	1									
<b>CHLOROPHYCEAE</b>													
<i>Actinastrum gracillimum</i>													2
<i>Ankistrodesmus falcatus</i>	3												2
<i>Ankistrodesmus convolutus</i>						1							
<i>Ankistrodesmus mirabile</i>	4	4	1		2								4
<i>Ankistrodesmus tumidus</i>	2	2	1		1								
<i>Chlorella</i> spp.		1	2										
<i>Closterium</i> sp.	1		1										
<i>Coelastrum microporum</i>	2				2								1
<i>Coelastrum reticulatum</i>	1												1
<i>Cosmarium</i> sp.	4	2											1
<i>Desmatostratum</i> sp.													1
<i>Kirchneriella lunaris</i>	2		1										
<i>Lagerheimia chodati</i>	1												1
<i>Micractinium pusillum</i>		1											
<i>Oocystis lacustris</i>	2	1	1		1								
<i>Pediastrum duplex</i>	1												
<i>Pediastrum boryanum</i>	3		1										
<i>Pediastrum tetras</i>	3												
<i>Schizochlamys gelatinosa</i>	1												
<i>Schroederia setigera</i>		1											
<i>Selenastrum gracile</i>		1											
<i>Scenedesmus</i> spp.	4	3		2	3								
<i>Tetradesmus wisconsinensis</i>	1												
<i>Tatraedron minutum</i>	1												1
<i>Tatraedron muticum</i>						1							
<i>Tetralantos lagerheimii</i>	1												
<i>Trebularia triappendiculata</i>													1
<i>Westella botryoides</i>	1	1		1									
Unidentified green cells			1										
<b>CILIATA</b>													
<i>Balanitozoon agilis</i>													1
<i>Chilodonella cucullulus</i>	2												1
<i>Cinetochilum margaritaceum</i>	3												
<i>Coleps hirtus</i>						2	2	1					
<i>Colpidium colpoda</i>						1							
<i>Cyclidium glaucoma</i>	2	3	3	1	1								2
<i>Cyclidium</i> spp.						1							
<i>Glaucoma pyriformis</i>						1							
<i>Halteria grandinella</i>						1							
<i>Holophrya viridis</i>									1				
<i>Lembadion bullinum</i>													1
<i>Lionotus fasciola</i>		1											
<i>Microthorax sulcatus</i>	3												
<i>Pleuronema chrysalis</i>													1
<i>Strobilidium</i> sp.	1												2
<i>Trachelocerca phoenicopterus</i>						1							
<i>Uronema marina</i>													
<i>Urotricha farcta</i>	2	3	1	1	2								2
<i>Vorticella</i> spp.	1		2	1									
<b>RHIZOPODA</b>													
<i>Actinophrys sol</i>	1												
<i>Amoeba vespertilio</i>		1											
<i>Amoebulae</i>													1
<i>Hartmanella hyalina</i>													3
<i>Microgromia</i> sp.						1							
<i>Nuclearia delicatula</i>	2												
<i>Rhaphidiophrys elegans</i>	1												1
<i>Rhaphidiophrys pallida</i>	2												1
<i>Vahlkampfia albida</i>						1							
<i>Vahlkampfia limax</i>													1
<i>Vampyrella</i> sp.						1							
<b>MASTIGOPHORA</b>													
<i>Bodo caudatus</i>							1	2	2	1	1		
<i>Bodo pulcher</i> <sup>1</sup>		1	2	2	1								2
<i>Dinomonas vorax</i>													
<i>Oicomonas socialis</i>	1												1
<i>Oicomonas termo</i>	2	1	2	1	2								1
<i>Phyllomitus amylophagus</i>						1							
<i>Physomonas vestita</i>		1	1										1
<i>Pleuromonas jaculans</i>	2												
<i>Pteridomonas pulex</i>													
<i>Spiromonas angusta</i>	1												
Unidentified colorless flagellates		4	2	2	2								3
Total number of species or genera	101	82	68	63	72								92

<sup>1</sup> Provisional name only.

The numbers of blooms at the downstream stations in comparison with the numbers at station I and in Cowan Creek are one evidence of enrichment. Further evidence is afforded by a comparison of the total number of organisms at each station. The numbers of organisms at sta-

Actually, the fertilization of the downstream waters is apparent, on the basis of a marked increase in the number of organisms, for only a few groups. The blue-green algae were up sharply at station III, but they declined thereafter. The Cryptophyceae first dropped sharply, then rose to high numbers at station V. This pattern is a common occurrence for the Cryptophyceae. They apparently are favorably influenced by recent fertilization, but they seem to avoid high BOD values. The same is true of the small colorless flagellates, whose behavior in a stream seems to differ from their behavior in a sewage treatment plant. This difference, however, may be a sampling fault, since most of these organisms occur on or near the bottom.

Some of the data in table 3 are very difficult to explain. For example, the number of ciliates dropped steadily until station V, where there was suddenly a fourfold increase. This increase, however, was due almost entirely to *Balanitozoon agilis* and *Urotricha farcta*, two related ciliates whose food is largely unknown. These might have been feeding on some small bacteria that develop late in the cycle of organic degradation. Just how far we are from being able to foretell, or account for, the presence of a given organism in a stream is emphasized in a

recent paper by Wuhrmann (14). He showed an inability to produce a given biota in effluents similar as to BOD, oxygen consumed, nitrate content, and so on. He concluded that there were still unknown organic substances present that determine the nature of the biota.

The Euglenophyceae, however, clearly demonstrate the effects of stream enrichment. They were the largest group in number of species at each station, but they were low in number of organisms at the Cowan Creek station and Lytle Creek I. At Lytle Creek V they were more abundant than any other group, except for the single bloom of *Cryptomonas erosa* that occurred there. The Euglenophyceae showed substantial increases at stations II, III, IV, and V, and they were the most abundant group at station II. At station III, only diatoms and small green cells (*Chlorella*) outnumbered them; at station IV, only diatoms.

Use of the whole group of Euglenophyceae as indicators of pollution or of recent pollution has been questioned (14).

In the present study, the genera *Cryptoglena*, *Euglena*, *Lepocinclus*, and *Phacus* were found to be well represented in the enriched or recently polluted water; and many of the species not only tolerated the condition, they multiplied in it. Most of the species of these four genera that

**Table 3. Total number of organisms<sup>1</sup> in all samples by station**

Group	Lytle Creek					Cowan Creek (6 S)
	I (6 S)	II (6 S)	III (5 S)	IV (5 S)	V (5 S)	
Schizomyctetes	92	224	4	1, 337	7	0
Myxophyceae	174	148	263	162	108	30
Chrysophyceae	16	0	0	0	1	1, 742
Cryptophyceae	1, 029	441	31	168	16, 778	434
Bacillarieae	1, 370	3, 217	3, 329	2, 690	797	1, 198
Volvocales	817	860	668	733	607	561
Euglenophyceae (green)	306	3, 633	1, 436	2, 617	10, 539	161
Euglenophyceae (colorless)	10	16	41	16	17	11
Chlorophyceae	664	723	7, 086	0	5, 253	212
Ciliata	46	35	10	9	194	20
Rhizopoda	20	6	1	23	17	3
Mastigophora	764	140	124	197	7, 830	122
Total	4, 925	9, 443	11, 845	8, 071	42, 287	4, 494

S=Samples.

<sup>1</sup> An organism in this paper usually means a single cell. Exceptions include filaments whose cells are distinguished with difficulty (such as *Beggiatoa* and *Lyngbya*) and some colonies (such as *Aphanocapsa*, *Spondylomorium*, and *Coelastrum*).

Table 4. Total number of *Trachelomonas* organisms in all samples, by station

Species	Lytle Creek					Cowan Creek
	I	II	III	IV	V	
<i>Trachelomonas crebea</i>	0	0	0	0	0	7
<i>Trachelomonas hispida</i>	0	2	0	0	0	1
<i>Trachelomonas stokesii</i>	0	0	1	1	96	0
<i>Trachelomonas teres</i>	1	0	0	0	0	36
<i>Trachelomonas urceolata</i>	2	364	8	32	1,092	54
<i>Trachelomonas volvocina</i>	36	2	8	8	648	12
Total	39	368	17	41	1,836	110

were found occurred at or below station II in Lytle Creek, and most of the occurrences of these genera were in the polluted or recovery areas.

The genus *Trachelomonas* offers a different story. It was represented by only 6 of its many species, and only 1 of these 6, *urceolata*, increased markedly in the area of pollution, as shown in table 4. This is in decided contrast to the genus *Euglena*, which was represented by 18 species. Table 5 shows the behavior of the nine most common of these. All achieved substantial to large increases at stations II, III, and IV. All except *Euglena quartana*, which is a saprophyte, were present either in Cowan Creek or Lytle Creek I but in very small numbers.

Actually, then, the occurrence of many of the Euglenophyceae was favored by existing or recent sewage pollution, and there were a few species, such as *Euglena acus*, *E. agilis*, *E. pisciformis*, *E. polymorpha*, *E. gracilis*, and *E. quartana*, *Lepocinclus ovum*, and *Trachelomonas urceolata*, which showed heavy increases as a result of such pollution. These same species may bloom for other reasons, of course.

A few other organisms, such as *Oicomonas termo* and *Chlorella* spp., certain chlamydomonads, and naviculoid diatoms, behaved in the same manner. On the whole, however, it is easier to list the organisms that died as a result of the pollution. Here special emphasis would be on the Chrysophyceae or the Chlorophyceae. Perhaps analysis of a much larger number of samples would show some additional species to be favorably influenced by the pollution.

One species not identified in samples from other Ohio Valley streams was found in this study. This was *Cephalomonas granulosa*, one of the Volvocales, which is apparently rare. It occurred in Cowan Creek once, at Lytle Creek I three times, and at Lytle Creek V once. No significance can be attached to these occurrences, although there were 216 organisms per milliliter in Lytle Creek I in one sample.

#### Comparison With a Florida Stream

It may be argued that the numbers of organisms in Lytle Creek are not unusual and therefore do not support the idea that heavy growths follow enrichment. Cowan Creek, which was used as a control, was fairly similar to Lytle Creek chemically and biologically. For a comparison with a stream having different characteristics, the Santa Fe River in north central Florida was selected.

No data on BOD, nitrates, nitrites, or phosphorus for the Santa Fe River are available. However, it received virtually no sewage or industrial pollution and probably little agricultural drainage. The Santa Fe differs from Ohio Valley streams in that it is a brown-water (tannic and perhaps humic acid) stream with a pH tending toward acidity.

The Santa Fe River and two small lakes that contribute to the headwaters of the river were routinely sampled in 1953-54. A total of 81 samples from six points in the river and one point in each of the lakes were analyzed for kinds and numbers of organisms. In these 81 samples, 332 species or genera of algae and protozoa were found. Roughly, this is two

times as many species in three times as many samples as were found in Lytle Creek. The groups of organisms found in the Santa Fe system, by station, are shown in table 6. It is evident from this table and from table 2 that routine sampling of any body of water of fair size will reveal a large variety of algae and protozoa, unless there is some special restrictive reason such as extreme pollution.

At one river station, Mikeville, cattle used the small slough-like branch of the river proper, and this water was at times polluted. The pollution was evidently mild, however. Forty-three of the forty-seven observed species of Euglenophyceae occurred at this station, but

none of them ever attained bloom proportions.

There were only three blooms in the river during the time it was studied. All three were at Mikeville: one of a species of *Gymnodinium*, one of *Ankistrodesmus falcatus*, and one of the minute green *Chlorella*. Hampton Lake had three blooms, and Sante Fe Lake had eight. Of the latter, four were late summer blooms of blue-green algae, quite in keeping with lake behavior. The bloom organisms did not enter the river to any extent because the very small amount of water draining from the lakes passes through marshy, grass-grown channels.

The Santa Fe, then, is a largely unpolluted stream that is rich in kinds of algae and pro-

**Table 5. Total number of certain Euglena organisms in all samples, by station**

Species	Lytle Creek					Cowan Creek
	I	II	III	IV	V	
<i>Euglena acus</i> .....	29	445	307	520	648	13
<i>Euglena agilis</i> .....	0	24	4	1	64	1
<i>Euglena deses</i> .....	0	4	22	13	8	1
<i>Euglena pisciformis</i> .....	82	60	461	279	85	1
<i>Euglena polymorpha</i> .....	24	102	40	145	532	1
<i>Euglena quartana</i> .....	0	0	0	709	0	0
<i>Euglena sciotensis</i> .....	2	42	2	36	16	3
<i>Euglena viridis</i> .....	14	260	5	256	297	1
Other species (mostly <i>Euglena gracilis</i> ).....	25	1, 904	115	620	6, 530	25
Total.....	176	2, 841	1, 356	2, 559	8, 180	46

**Table 6. Number of species in principal groups of algae and protozoa occurring in 81 samples from the Santa Fe River system, Fla., 1953-54**

Group	Santa Fe Lake (12 S)	Hamp-ton Lake (5 S)	Waldo (12 S)	Worth-ing-ton Springs (10 S)	Mike-ville (9 S)	Oleno (13 S)	High Springs (11 S)	Bell (9 S)
Schizomyctetes.....					1	1		
Myxophyceae.....	11	6	4	4	13	6	5	6
Chlorophyceae:								
Volvocales.....	3	3	1	3	13	6	3	7
Other.....	30	25	7	10	53	13	4	13
Xanthophyceae.....	1	2	1	0	5	1	0	1
Chrysophyceae.....	6	4	5	5	5	4	3	1
Cryptophyceae.....	3	2	5	3	5	2	3	3
Dinoflagellata.....	7	9	1	5	8	5	2	3
Euglenophyceae.....	4	1	0	12	43	15	12	4
Bacillarieae.....	16	7	11	22	16	25	21	21
Mastigophora.....	4	2	6	1	13	3	7	2
Rhizopoda.....	3	1	7	7	17	3	5	5
Ciliata.....	17	3	8	7	17	6	8	6
Total species.....	105	65	56	79	219	90	73	72

S=samples.

tozoa, but poor in numbers of organisms. It contained many organisms common to Lytle Creek, and the increase in kind and number of organisms at the Mikeville station indicates that it might well exhibit blooming if well fertilized. These observations strengthen the idea that plentiful enrichment of a stream causes a great increase in organisms, and also that the kind of bloom is a function of the type of enrichment. At Mikeville, where the water was muddied by cattle and polluted by their droppings, a sharp and heavy increase in Euglenophyceae occurred. This fact and the Lytle Creek study both indicate that some Euglenophyceae increase as a result of fecal pollution.

### Bloom Potentials

A plentiful supply of the proper nutrients is certainly essential for blooming. That the nature of the nutrient material determines both the strength and nature of blooming has been indicated by a number of observations. In the laboratory at the University of Florida, for example, commercial fertilizer has been repeatedly added to concrete tanks that are filled with water from a small brook. The brook is spring-fed but it contains a varied plankton, including Euglenophyceae. These tanks develop heavy blooms—of small Chlorophyceae. A few *Euglena*, *Phacus*, and *Lepocinclis* organisms occur in the bloom, but their numbers are always small. As another example, never in any pond I have observed has the addition of commercial fertilizer produced a bloom of *Euglena sanguinea*; but when similar ponds are invaded by cattle this organism frequently blooms heavily.

In addition to the proper nutrients, the proper seed must be present. Few protozoa or algae, however rare they may be, seem likely to be absent in most environments. There are broad limits—acid water vs. hard; low salinity vs. high—for certain species or groups. *Gonyostomum semen* is practically never found in hard water, and *Gymnodinium brevis* has never been recorded from any part of the world other than the Gulf of Mexico off the Florida coast and Trinidad, B. W. I. (16). Instances such as these are rare, however, and probably would be greatly decreased by additional and much

more critical observation in many parts of the world. In almost every instance in which a single group of organisms has been studied extensively in a particular geographic area, investigators have found most of the known species of that group (within their broad ecologic limits). A recent example of this is the study by Decloitre (17) of the thecate rhizopods in French Equatorial Africa. He found most of the known species. He recognized climate as a barrier for some species, but also stated: "The intertropical zone is little known as a whole; it is very probable that a certain number of these species will be found, sooner or later, in this climatic zone and will be recognized as ubiquitous."

It is unwise to state that a micro-organism species—that is, the seed—is absent from a given environment. One reason is that the environment may not have been adequately sampled; another is that the sample may not have been completely analyzed. It is difficult to examine completely even a single drop of water in a sample. Many workers make one examination, then set the slide aside in a moist chamber to reexamine later. The question inevitably arises as to what size sample must be analyzed to yield a given species. Or otherwise stated, what is the chance of finding a given species in a random sample?

Fisher, Corbett, and Williams (18) consider that the majority of species are rare, only a few being common. Therefore, the species in a biological group would not be equally abundant, even though an environment might be sampled a number of times under uniform conditions. This is equivalent to stating that conditions in the habitat sampled were optimal or nearly so for the "common" species, but only within the range of tolerance for those that occurred less frequently. I do not recall ever having seen *Trachelomonas reticulata* but once, despite having examined thousands of samples of foul water, presumably its preferred habitat. This one occasion was a sample from a tree hole, and it contained a dense population of this species.

No answer has been evolved thus far as to approximating the maximum probability of finding a given species. It may reside in knowing the preferred habitat for the species, then sampling as near to it as possible. The range

of tolerance should be known, too. That some organisms exhibit a wide range is shown by the studies of Lytle Creek and the Santa Fe River. Lytle Creek is a hard-water stream, well fertilized, in a temperate zone. The Santa Fe is a larger, soft-water stream, with little fertilization and probably much tannic and humic acid, located in a subtropical environment. Yet these streams had 99 species in common. In addition, many of the species occurring in only one of these streams have been found in habitats near the other stream. More complete analyses, or perhaps more numerous ones, would probably reduce still further the species found in only one or the other area. The question, then, is what peculiar conditions give rise to an abundance of a given species.

Such considerations as these emphasize the importance to the ecologist of careful chemical and physical studies of a habitat. Perhaps we may yet be able to say with certainty that, since an environment presents certain characteristics, we can expect to find certain species there.

### Summary and Conclusions

In comparative studies of three streams in the United States, quantitative and qualitative determinations of the suspended algae and protozoa provided specific evidence of the fertilizing effects of a treated sewage effluent on some species of these organisms.

In Lytle Creek, a small stream in southwestern Ohio which receives effluent from a primary sewage treatment plant, a total of 167 species were found. Certain species of Euglenophyceae were exceptionally abundant at points below the plant outfall. Chlorophyceae and Chrysophyceae were adversely affected by the effluent.

Of 92 species of microbiota in Cowan Creek, a similar but unfertilized stream in the same area, only Chrysophyceae and diatoms (Bacillarieae) were abundant.

In the Santa Fe River, a larger unfertilized stream in Florida, 332 species were found, but none of them occurred in large numbers.

Species common to both the Ohio and Florida waters totaled 99, indicating a wide environmental tolerance for these species.

The more intensively a given environment is

sampled, the greater is the possibility of finding a given species therein, provided the environment falls within its range of tolerance. The environmental ranges of many micro-organisms are wide enough for the organisms to be termed ubiquitous. But such organisms may reproduce rapidly enough to form blooms only within a narrow range the critical factor, or combination of factors, of which rarely occurs. Recent fecal pollution appears to be one such factor for certain species of Euglenophyceae. The same environment appears to be limiting for some species of Chrysophyceae.

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*A list of the micro-organisms found in the Santa Fe River may be obtained from the author.*

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## Air Pollution Research

Five Federal agencies have been awarded contracts for community air pollution research in the Public Health Service air pollution program, for use during fiscal year 1956.

The Weather Bureau, Department of Commerce, allocated \$196,000, is studying the dilution and dispersal of contaminants in the atmosphere. The assignment includes devising ways of surveying problem areas, evaluating existing weather data to determine air pollution potentialities, and predicting weather conditions that may intensify air pollution.

The National Bureau of Standards, Department of Commerce, has been allocated \$98,000 for developing methods of analyzing and identifying various gaseous contaminants of the atmosphere. This bureau is exploring ways of collecting and treating condensable pollutants and of analyzing concentrated samples of the atmosphere. It is also studying reactions among gases and other chemicals in the air.

The Bureau of Mines, Department of the Interior, also allocated \$98,000, is investigating causes of inadequate incineration of combustible wastes and means of improving incineration. It will study sulfur dioxide removal processes and evaluate elements from internal combustion in engines which may contribute to air pollution. It will also sample a limited selection of stack effluents.

Additional agreements with other Federal agencies include one with the Library of Congress for the preparation of a continuing annotated air pollution bibliography and one with the Department of Agriculture for the assignment of a plant physiologist to the program. The physiologist will initiate investigation of the use of plants as air pollution indicators and assist in coordinating the air pollution activities of the Service and the Department of Agriculture.

Contracts for research to be conducted by non-Federal agencies were consummated with the following: Baylor University for a preliminary study to determine the feasibility of using tissue enzymes to evaluate the toxicity of air pollutants (\$34,000); the University of Nebraska for a study to determine the feasibility of using tissue culture to evaluate the toxicity of air pollutants (\$31,000); the State College of Washington for the development of an automatic air pollution sampling and recording instrument (\$17,590); and the Franklin Institute for a study of the feasibility of collecting and storing air samples by compressing atmospheric air and storing it in suitable containers for subsequent chemical or physical analysis of vapor-phase contaminants (\$16,064). Other contracts for research are being negotiated.

# Diagnosis of Psittacosis in Parakeets

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THE RECENT remarkable increase in the popularity of parakeets (budgerigars) as household pets poses a question of whether this trend has been accompanied by a rise in the incidence of psittacosis. With increasing awareness of this disease, there has undoubtedly been a tendency to diagnose and report cases which in other times might not have been identified. Nevertheless, there appears to have been a real rise in the attack rate of psittacosis (1, 2). This emphasizes the need for a rapid and simple diagnostic test for psittacosis that can be used by local laboratories.

The clinical resemblance of psittacosis to other forms of pneumonitis and influenza-like illnesses makes confirmation of the diagnosis by laboratory methods almost mandatory. Early antibiotic therapy, so often employed today, makes impossible the diagnosis of psittacosis by

isolation of the virus from suspected human cases. Such therapy may also suppress or delay antibody development, leaving the physician without any direct laboratory support for his clinical diagnosis. Quite often the pet parakeet or other psittacine contact may be the only supportive evidence for such diagnosis.

Psittacosis virus may cause an apparent or inapparent infection in birds, but even in the overt disease the symptoms are not pathognomonic. Moreover, apparently healthy birds frequently shed psittacosis virus. Physical examination of the bird is insufficient for a correct diagnosis in sick birds and entirely inadequate for the detection of silent infections. The isolation of the virus from infected birds offers the most accurate diagnostic method, but it entails sacrificing of the birds to obtain tissues, a procedure often objected to by an owner for sentimental reasons and by breeders or dealers for economic reasons. Therefore, a less expensive test was sought, one which would reliably detect infection in live birds.

Serologic tests, particularly complement fixation tests, have proved to be of diagnostic value with human serums (3). The complement fixation test has also been found to be useful in tests with pigeon and parrot serums (4, 5). The serums of domestic fowl, while not reacting in the usual complement fixation test, will yield definitive results when tested by the indirect complement fixation test (6, 7). The serums of sea birds infected with psittacosis virus also have been shown to react in the direct complement fixation test (8).

It appeared desirable, therefore, to compare

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the results of the complement fixation test on serums of parakeets bled during life with results of virus isolation attempts from their droppings and from their tissues when they were subsequently sacrificed and to investigate the possibilities of practical application of serologic techniques for the detection of infected flocks.

### Materials and Methods

The parakeets in this preliminary study were obtained from 19 different owners of small "backyard" aviaries in the vicinity of Albany, Ga., except for one flock which was selected from a larger group confiscated by the State of New Jersey.

#### *Bleeding of Parakeets*

Serum was obtained from the parakeets by bleeding from the jugular vein, using a 25-gauge,  $\frac{1}{2}$ -inch hypodermic needle attached to a 1.0-ml. tuberculin syringe which was previously wetted with physiological saline solution. The parakeets were anesthetized with ether before bleeding. One ml. of blood was withdrawn and the serum separated from the clot by centrifugation. The birds withstood the removal of 1.0 ml. of blood quite well. In fact only one bird of this series died following the bleeding, and this death was apparently caused by excessive anesthesia.

#### *Antigen*

Two psittacosis antigens were used. The first antigen was prepared from allantoic fluids of chick embryos infected with psittacosis virus recently isolated from a parakeet. The embryos were inoculated intra-allantoically with  $10^{-1}$  or  $10^{-2}$  dilutions of virus on the eighth day of incubation and the fluids were harvested 5 to 6 days later. These were centrifuged at 1,000 r.p.m. for 10 minutes and heated at  $100^{\circ}$  C. for 20 minutes or treated with phenol in 0.5 percent concentration. The second antigen consisted of heated and phenolized yolk sac material from infected chick embryos.

#### *Complement Fixation Test*

The procedure for the complement fixation test was as follows:

Serial fourfold dilutions of heated inactivated serums were made in veronal buffered saline. The first dilution varied from 1:2 to 1:8, depending upon the quantity of serum available. The serum dilutions were distributed in 0.1-ml. volumes to 3 rows of tubes. The first row was the test row and received 0.1 ml. of psittacosis antigen in optimal dilution. The second row served as a control for nonspecific reactions and received 0.1 ml. of normal allantoic fluid in the same dilution. The third row measured anticomplementary activity of the serum; it was given 0.1 ml. of veronal buffered saline.

To each tube was added 0.2 ml. of complement diluted to contain 1.5 to 2 units. The tubes were placed in the refrigerator overnight. Following this, 0.2 ml. of sensitized sheep cells (consisting of equal volumes of 2 percent cells and optimally diluted hemolysin) were added and the tubes incubated at  $37^{\circ}$  C. for 30 minutes. The titers represent serum dilutions which gave 3+ or 4+ readings followed by readings of "zero." When a 4+ was followed by a 1+ or 2+ reading, the titer was interpolated as being midpoint between the two dilutions. For example, if 1:16 dilution gave a reading of 4+, and 1:64 read 2+, the titer was considered to be at 1:32.

Each test was accompanied by the usual positive, negative, hemolytic system and cell controls. Unpublished results obtained in this laboratory indicate that human serums can be tested successfully with either psittacosis or lymphogranuloma venereum (LGV) antigens, but parakeet serums tended to react more specifically with psittacosis antigen in the complement fixation test. The psittacosis antigen may be preferable, therefore, for the testing of bird serums.

The indirect complement fixation test was performed by incubating at  $37^{\circ}$  C. for 1 hour 0.1 ml. each of the test serum, complement (2 units), and antigen (2 units). After this 0.1 ml. of a psittacosis immune mammalian serum (2 units) was added and the mixture again incubated for 1 hour at  $37^{\circ}$  C. Finally 0.1 ml. of 4 percent sensitized sheep cells was added and readings were made after 45 minutes incubation at  $37^{\circ}$  C.

Each test was accompanied by a direct fixa-

tion control in which a negative mammalian serum was substituted for the mammalian psittacosis positive serum. The usual controls for nonspecific, anticomplementary, and hemolytic reactions were also included for each test serum. Any serum which inhibited the fixation of complement by the known positive serum as indicated by readings of "zero," 1+, or 2+ was considered positive even if this reaction was observed only in the most concentrated dilution.

### Virus Isolation

For virus isolations from excreta, the droppings from individually caged birds were suspended in a solution of 10-percent horse serum in buffered water, the proportions being approximately 1:3 by volume. After centrifugation at 300 times gravity for 10 minutes, the supernate was removed. Streptomycin sulfate was added in concentrations of 2.0 mg. per ml. of supernate, and the mixture was inoculated in volumes of 0.3 ml. intraperitoneally into groups of 3 to 5 mice which were 3 to 4 weeks old. Psittacosis virus was considered isolated when the mice developed ascites or died, with typical elementary bodies being demonstrated in smears from the peritoneal serosa.

When testing for virus in the tissues, an approximate 20 percent suspension of the liver and spleen of each bird was prepared and inoculated intracerebrally in volumes of 0.03 ml. into groups of 5 mice. Demonstration of elementary bodies in the smears from the meninges following a typical course of symptoms and death was the criterion of virus isolation.

### Results

The results observed from testing 130 parakeets for both the presence of specific direct complement-fixing antibody in their serum and for virus in their tissues are shown in table 1. There was agreement between the two tests in 85 of 125 birds (5 were unsatisfactory in the complement fixation test). Of 30 birds from which virus was isolated, the serum of 5 failed to give a reaction in the complement fixation test. It is possible that serums from these birds were taken early in the infection prior to the development of demonstrable antibodies. The serum of

**Table 1. Psittacosis virus isolations from serologically positive and negative parakeets**

Results	Serums reacting to—	
	Direct CF test	Indirect CF test
Negative serologically; no isolation	61	26
Positive serologically; isolation	24	23
Positive serologically; no isolation	35	35
Negative serologically; isolation	5	3
Total	125	87

a sixth bird was anticomplementary. No virus was isolated from 35 of the 59 birds whose serums gave a positive complement fixation reaction. This could mean that the virus isolation test was not sensitive enough to detect the amounts of virus present at the time, or that these birds had actually recovered from psittacosis infection and were free of virus but still possessed circulating antibody.

Birds from 13 flocks failed to yield virus when their livers and spleens were tested (table 2). Fifty-five of the fifty-eight birds so represented also failed to show complement-fixing antibody in their serums. Both tests yielded

**Table 2. Comparison of virus isolations made from flocks with and without antibodies to psittacosis**

Flock No.	Number parakeets tested	Number CF positive	Number virus isolations
1	24	21	15
2	5	2	2
3	3	1	0
4	8	1	0
5	5	2	1
6	4	4	3
7	4	1	0
8	5	2	4
9	25	25	4
10	5	0	0
11	11	0	0
12	3	0	0
13	3	0	0
14	4	0	0
15	3	0	0
16	4	0	0
17	1	0	0
18	3	0	0
19	6	0	0

positive results in 6 aviaries. The degree of correlation varied from 15 virus isolations versus 21 positive complement fixation tests (aviary 1) to 4 isolations versus 25 positive complement fixation tests (aviary 9). These findings may signify differences in the duration of infection in these 2 aviaries.

From flocks known to be infected, 74 parakeets were selected for a comparison of results of virus isolation from the droppings taken during life and from the liver and spleen at autopsy when sacrificed. Several samples of droppings were tested from some of these birds; only single samples were tested from others. Serum specimens were taken from all of the

birds for parallel serologic studies. The results are shown in table 3.

Of the 23 parakeets in which tissues yielded psittacosis virus, only 13 shed virus in their droppings. The age or sex of the bird did not appear related to the excretion of virus. Virus was isolated from the droppings of one young female parakeet although no virus was obtained from its liver and spleen upon autopsy. In most cases repeated samples of droppings were taken at weekly intervals. Only 2 of the 10 birds which gave evidence of virus in any of three fecal specimens were excreting detectable amounts in all three samples.

The five birds with serums that gave positive

**Table 3. Correlation of the presence of psittacosis virus in tissues and droppings and complement fixation antibody titers in individual parakeets**

Parakeet No.	Age	Sex	Virus in tissue	Virus in droppings			CF anti-body titer	Parakeet No.	Age	Sex	Virus in tissue	Virus in droppings			CF anti-body titer
				1	2	3						1	2	3	
1	y	f	-	-	-	-	<1:8	38	y	nd	-	-	-	-	<1:2
2	y	f	-	-	-	-	<1:8	39	y	nd	+	+	-	-	<1:8
3	y	f	-	-	-	-	<1:8	40	A	f	+	-	-	-	<1:2
4	y	f	-	-	-	-	<1:8	41	A	f	-	-	-	-	1:32-1:64
5	y	m	-	-	-	-	<1:8	42	y	f	-	-	-	-	<1:8
6	y	nd	-	-	-	-	1:32	43	A	f	-	-	-	-	<1:4
7	y	nd	+	-	-	+	1:32	44	A	f	-	-	-	-	<1:8
8	A	nd	+	-	-	-	1:8	45	A	f	-	-	-	-	<1:4
9	y	nd	+	-	-	-	1:8-1:16	46	A	m	-	-	-	-	<1:4
10	y	nd	-	-	-	-	<1:8	47	y	m	-	-	-	-	<1:4
11	y	nd	+	-	-	-	1:8	48	A	f	+	+	-	-	<1:4
12	y	nd	-	-	-	-	1:8-1:16	49	A	f	+	-	-	-	<1:4
13	y	nd	+	-	+	+	1:128	50	A	f	+	-	-	-	1:16
14	A	m	+	-	+	-	1:128	51	y	f	-	-	-	-	1:2
15	y	m	+	+	+	+	1:128	52	y	m	+	-	-	-	<1:4
16	nd	nd	+	-	+	+	1:32	53	A	f	+	-	-	-	1:20
17	A	nd	-	-	-	+	1:8	54	A	f	-	-	-	-	1:40
18	y	f	+	+	+	-	AC	55	A	f	-	-	-	-	1:16
19	A	m	+	-	+	+	1:128	56	A	f	+	-	-	-	1:32
20	y	f	+	+	+	+	1:8	57	y	m	-	-	-	-	1:40
21	y	f	-	+	-	-	1:8	58	y	m	-	-	-	-	1:8
22	nd	nd	+	-	-	-	1:32-1:64	59	y	m	-	-	-	-	1:40
23	A	m	-	-	-	-	<1:8	60	y	m	-	-	-	-	1:4
24	A	f	-	-	-	-	1:8	61	y	m	-	-	-	-	1:8
25	A	f	-	-	-	-	1:8	62	A	f	-	-	-	-	1:8
26	A	m	+	+	-	-	1:128	63	A	f	-	-	-	-	1:164
27	A	f	-	-	-	-	1:32	64	A	m	-	-	-	-	1:5
28	nd	nd	-	-	-	-	1:4	65	A	m	-	-	-	-	1:5±
29	nd	nd	-	-	-	-	1:8	66	A	m	-	-	-	-	1:64
30	y	f	+	+	+	-	<1:8	67	A	f	-	-	-	-	1:16
31	nd	nd	-	-	-	-	<1:8	68	A	f	-	-	-	-	1:10
32	A	m	-	-	-	-	<1:2	69	A	m	-	-	-	-	1:16
33	y	nd	-	-	-	-	<1:2	70	A	m	-	-	-	-	1:40
34	y	f	-	-	-	-	<1:2	71	A	f	-	-	-	-	1:40
35	y	nd	-	-	-	-	<1:2	72	A	f	-	-	-	-	1:5
36	y	nd	-	-	-	-	<1:8	73	A	f	-	-	-	-	1:64
37	y	nd	-	-	-	-	<1:2	74	A	m	-	-	-	-	1:5

y=young; A=adult; nd=not determined; - =virus not isolated; + =virus isolated; f=female; m=male; AC=anticomplementary.

<sup>1</sup> Or greater.

complement fixation reactions at dilutions of 1:128 or greater were all shedding virus in their droppings. However, several which shed virus had CF titers of only 1:8, and three birds yielding virus from both droppings and tissues had no demonstrable CF antibodies. Possibly, the latter two groups of birds were in early stages of infection. Further studies on the pathogenesis and immunology of the disease in birds are necessary for proper interpretation and correlation of these data.

Of one flock of 49 birds examined by the complement fixation test, the serums of 25 reacted with psittacosis antigen. Ten of the reactors were removed and isolated from the flock 12 days later, and attempts were made to isolate virus from their droppings. Virus was recovered from only 2 of the 10. The remaining 15 reactors were then isolated from the flock 49 days after the original testing, and again virus was isolated from the droppings of 2 of these birds.

Fifty-five days after the first bleeding, second serum specimens were collected from the 24 birds which previously had shown no antibody. By this time all but one bird gave positive CF reactions with psittacosis antigen. Between the time of the first and second bleeding, breeding activities were initiated in this flock. This circumstance, plus the delayed removal of infected birds, may have been responsible for the apparent spread of infection within this flock.

A large group of young parakeets obtained from a wholesale dealer in New Jersey became available for study. Fifty of these birds were killed and their tissues tested for the presence of virus. Five of these yielded psittacosis virus. However, no antibody could be demonstrated in 197 serums by repeated direct complement fixation tests in which all controls indicated a satisfactory test.

These serums were then examined by the indirect complement fixation test. The type of correlation to be expected within an infected flock became apparent with the results obtained by this indirect test. Of 87 parakeets tested by both serologic and virus isolation techniques, 26 were negative by both tests, 23 were positive by both tests, 35 were serologically positive but failed to yield virus, while 3 were serologically

negative yet virus was isolated from their tissues (table 1).

### Summary and Conclusions

In the parakeets studied in this series, a close correlation was demonstrated between the results of complement fixation tests for psittacosis antibody and of virus isolation from tissues. Psittacosis virus was isolated from 47 of the 117 birds showing either direct or indirect complement fixation antibody titers of 1:2 or greater. Virus was not isolated from 87 of 95 parakeets whose serums contained no demonstrable antibodies. Most of the birds with antibody from which virus could not be isolated were obtained from known infected flocks. Conversely, only the serums of 3 of 55 birds obtained from flocks considered to be free of psittacosis virus (on the basis of a 10 percent sampling) reacted positively to the complement fixation test and then only in a low titer. A larger sample might have indicated that virus was present in the two flocks from which these birds came.

The significance of a positive titer in relation to the infectiousness of an individual bird remains to be determined, but the finding of at least some birds with antibodies may be regarded as evidence of past or present infection in that flock. Such a flock should be suspected and the birds with negative serums should be retested in 3 to 6 weeks. The presence of additional birds with antibodies at this time would provide presumptive evidence that active infections were present in the aviary. Continued absence of antibodies in a flock may be considered an indication of absence of current active infection.

The reason why some birds develop antibodies that can be detected in the direct complement fixation test while others develop only indirect complement-fixing antibodies is not understood. However, the results indicate that parakeet serums should be subjected to both tests before being considered negative.

Although isolation of virus will remain the most conclusive method for the diagnosis of psittacosis in individual birds, this expensive and time-consuming procedure need not be applied for the detection of infection in flocks.

Where facilities for virus isolation do not exist, or the number of birds to be tested is excessive, the complement fixation test should prove to be especially valuable. Aside from being one of the more reliable of the complement fixation tests for virus, it is relatively rapid and simple. This test should be added to the diagnostic armamentarium of every local public health laboratory.

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## Increase in Juvenile Delinquency

The Children's Bureau, Department of Health, Education, and Welfare, has been receiving an increasing number of requests for help from States and communities who are trying to plan services for delinquent children more effectively.

The Bureau reported on May 20 that about a half million children were brought to juvenile courts for delinquency in 1955 and that juvenile delinquency continued to increase during that year. The Bureau, which annually receives reports from a number of juvenile courts on the juvenile delinquency cases they handle, has prepared preliminary estimates of the rates of increase.

Some 977 courts reporting to the Bureau in both 1954 and 1955 experienced a 9-percent increase in juvenile delinquency cases over that period. Likewise, a trend group of 383 courts which have been reporting for many years also show a 9-percent increase in the 1954-55 period. While the increases in cases

were occurring, the child population in the 10-17 age group went up only about 3 percent. Generally, this is the age group within the jurisdiction of the juvenile court.

Not all children brought to attention of the police have committed offenses serious enough to warrant court action. The 9-percent increases in juvenile court cases may underestimate the actual increase in the number of juvenile delinquents in 1955. For example, the latest Federal Bureau of Investigation uniform crime report shows an 11.4 percent increase in police arrests of young persons under 18 in 1955 as compared with 1954. The FBI report is based on data from 1,162 cities.

Hopefully, joint efforts of local, State, and Federal groups can pull the delinquency rate down. Toward that end, consultants in the Bureau's Juvenile Delinquency Service Division are working with local communities and States in planning prevention and treatment programs.

## *Surgical Experience in Selected Areas of the United States*

The era of modern surgery began only about 1875, although more than 20 centuries ago some surgical operations were performed, with much pain and suffering for the patient and an exceedingly high case fatality. Nearly all of the major developments that have made surgery safe and widely used have come since about the middle of the 19th century.

The use of surgery and related procedures in the armed forces has increased considerably in the past 50 years. However, the numbers of certain of the most frequent operations, such as tonsillectomy and appendectomy, have declined in the past 10 years.

Surveys of some years ago indicated that tonsils had been removed in roughly 40 percent of 15-year-old children and appendixes had been removed in 10 percent of 24-year-old persons.

Illness surveys of households in selected areas in the United States indicate that tonsillectomy is the most frequent surgical operation among persons of all ages combined, with surgery for accidents and appendectomy second and third. However, benign tumors except of the female genital organs had the largest percentage of cases treated surgically, with appendicitis second and congenital malformations third. In terms of five broad age groups, tonsillectomy is first in frequency in the two age groups under 15 years, second in the three age groups 15-64 years, but is ninth at 65 and over. Appendectomy is tenth in frequency under 5 years of age, third in the three age groups 5-44 years, fifth at 45-64, and is not found among the 10 most frequent operations at 65 and over. Accidents, except poisoning, were the first cause of surgery in the four age groups above 15 years, and the second cause in the two age groups under 15.

It is generally but not invariably true that

relative variation with age is greater in surgical rates per 1,000 population than in percentage of cases treated surgically.



### Public Health MONOGRAPH

### No. 38

The accompanying summary covers the principal findings presented in Public Health Monograph No. 38, published concurrently with this issue of Public Health Reports. The authors are with the Division of Public Health Methods, Public Health Service.

Readers wishing the data in full may purchase copies of the monograph from the Superintendent of Documents, Government Printing Office, Washington 25, D. C. A limited number of free copies are available to official agencies and others directly concerned on specific request to the Public Inquiries Branch of the Public Health Service. Copies will be found also in the libraries of professional schools and of the major universities and in selected public libraries.

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Collins, Selwyn D., Lehmann, Josephine L., and Trantham, Katharine S.: *Surgical experience in selected areas of the United States*. Data on surgical operations from periodic canvasses of households, supplemented by United States Navy reports and nationwide hospital surveys. Public Health Monograph No. 38 (Public Health Service Publication No. 473). 48 pages. Illustrated. U. S. Government Printing Office, Washington, D. C., 1956. Price 35 cents.

Among the surgical operations with rather definitely higher rates for males are those for accidents except poisoning, hernia, hemorrhoids, and ulcer of the stomach and duodenum. Among operations with definitely higher rates for women are those for cholecystitis and biliary calculus, thyroid diseases, malignant neoplasms, diseases of the bones, joints, and other organs of locomotion, and appendicitis in the young adult ages.

Major surgery was considerably more frequent among females than among males, with a peak at 30 years and with lower rates at younger and older ages. Among males, major surgery increased rather consistently with age,

with the highest rate in the oldest age group. The peak of all minor operations comes at 5-9 years of age, with only a moderately lower rate for children under 5 years.

The American Hospital Association's published report on a survey of 1949 includes an estimate of more than 9 million operations in all hospitals in the United States. However, the proportion of operations performed in long-term hospitals, such as those for mental diseases and tuberculosis, is relatively small. Estimates for short-term hospitals only, based on the association's report, indicate some 7,200,000 operations or a rate of 49 operations in short-term hospitals per 1,000 population of the United States.

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## technical publications

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### Protecting Children in Adoption. Report of a Conference

*Children's Bureau Publication No. 354. 1955. 20 cents.*

Of the threefold interests in every adoption—the child, his natural parents, and his adoptive parents—that of the child is paramount. This was the major conclusion arrived at in a conference of 31 national organizations of the medical, legal, and social professions considering the protection of children in adoption. Any discussion of adoption leads back to the unmarried mother, and medical, legal, and social services for the unmarried mother are the first line of defense.

Some of the points brought out were:

Placement of the child in an adoptive home involves team work of doctors, lawyers, and social workers and for this reason, placements are best made in a community-sponsored setting, by an agency authorized for the purpose.

Unmarried pregnant girls are getting less medical care and later in pregnancy than married women.

Some of the most vicious "black market" cases involve girls frightened or coerced into signing a relinquishment for their babies before or immediately after delivery, in order to get medical and hospital care.

Many doctors are unaware of existing social agencies in their communities, particularly those designed to help unmarried mothers.

### New Hope for the Disabled

*Office of Vocational Rehabilitation Publication VR-ISC-13. 1956. 23 pages; illustrations. 15 cents.*

The major provisions of the Vocational Rehabilitation Amendments of 1954 (Public Law 565) are outlined and explained in this booklet. It lists the services available to the handicapped under the new law, summarizes the three-part Federal grant-in-aid structure established by

that law, and delineates the role of the Office of Vocational Rehabilitation in the State-Federal rehabilitation program.

The amendments to the Randolph-Sheppard Act (1954) and such related legislation as the Medical Facilities Survey and Construction Act of 1954 and the Social Security "disability freeze" amendments of the same year are discussed.

Listed are the names and addresses of regional representatives of the Office of Vocational Rehabilitation and locations of the main offices of the State vocational rehabilitation agencies from whom further information may be obtained.

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This section carries announcements of all new Public Health Service publications and of selected new publications on health topics prepared by other Federal Government agencies.

Publications for which prices are quoted are for sale by the Superintendent of Documents, U. S. Government Printing Office, Washington 25, D. C. Orders should be accompanied by cash, check, or money order and should fully identify the publication. Public Health Service publications which do not carry price quotations, as well as single sample copies of those for which prices are shown, can be obtained without charge from the Public Inquiries Branch, Public Health Service, Washington 25, D. C.

The Public Health Service does not supply publications issued by other agencies.